Apprenticeship and Industry Training

Plumber

Apprenticeship Course Outline

0605.1 (2005)

Government of Alberta

Apprenticeship and Industry Training

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Plumber
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Course Outline

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Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding an employer. Employers hire apprentices, pay their wages and provide on-the-job training and work experience. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyperson or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution – usually a college or technical institute.

To become certified journeypersons, apprentices must learn theory and skills, and they must pass examinations. Requirements for certification—including the content and delivery of technical training—are developed and updated by the Alberta Apprenticeship and Industry Training Board on the recommendation of Plumber Provincial Apprenticeship Committee.

The graduate of the plumber apprenticeship program is a certified journeyperson who will be able to:

- install and maintain all plumbing systems, including hot liquid heating, water supply, water treatment, related hospital systems and compressed air and vacuum systems
- fabricate and install any of the pipe systems used for various purposes in buildings, using any type of pipe: steel, cast iron, copper, plastic, etc.
- provide safe and efficient systems which function well in conjunction with other systems
- know the rules and codes governing installations
- read and interpret plans and specifications and prepare layouts and working drawings
- be proficient with the safe use of hand tools, powered machines and equipment
- calculate material quantities
- detail components and fixtures according to specifications and assume responsibility for the end product
- relate to job situations and other trades that precede or follow
- perform assigned tasks in accordanc with quality and production standards required by industry

Apprenticeship and Industry Training System

Industry-Driven

Alberta's apprenticeship and industry training system is an industry-driven system that ensures a highly skilled, internationally competitive workforce in more than 50 designated trades and occupations. This workforce supports the economic progress of Alberta and its competitive role in the global market. Industry (employers and employees) establishes training and certification standards and provides direction to the system through an industry committee network and the Alberta Apprenticeship and Industry Training Board. The Alberta government provides the legislative framework and administrative support for the apprenticeship and industry training system.

Alberta Apprenticeship and Industry Training Board

The Alberta Apprenticeship and Industry Training Board provides a leadership role in developing Alberta's highly skilled and trained workforce. The board's primary responsibility is to establish the standards and requirements for training and certification in programs under the Apprenticeship and Industry Training Act. The board also provides advice to the Minister of Advanced Education and Technology on the needs of Alberta's labour market for skilled and trained workers, and the designation of trades and occupations.

The thirteen-member board consists of a chair, eight members representing trades and four members representing other industries. There are equal numbers of employer and employee representatives.

Industry Committee Network

Alberta's apprenticeship and industry training system relies on a network of industry committees, including local and provincial apprenticeship committees in the designated trades, and occupational committees in the designated occupations. The network also includes other committees such as provisional committees that are established before the designation of a new trade or occupation comes into effect. All trade committees are composed of equal numbers of employer and employee representatives. The industry committee network is the foundation of Alberta's apprenticeship and industry training system.

Local Apprenticeship Committees (LAC)

Wherever there is activity in a trade, the board can set up a local apprenticeship committee. The board appoints equal numbers of employee and employer representatives for terms of up to three years. The committee appoints a member as presiding officer. Local apprenticeship committees:

- monitor apprenticeship programs and the progress of apprentices in their trade, at the local level
- make recommendations to their trade's provincial apprenticeship committee (PAC) about apprenticeship and certification in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- make recommendations to the board about the appointment of members to their trade's PAC
- help settle certain kinds of disagreements between apprentices and their employers
- carry out functions assigned by their trade's PAC or the board

Provincial Apprenticeship Committees (PAC)

The board establishes a provincial apprenticeship committee for each trade. It appoints an equal number of employer and employee representatives, and, on the PAC's recommendation, a presiding officer - each for a maximum of two terms of up to three years. Most PACs have nine members but can have as many as twenty-one. Provincial apprenticeship committees:

- Make recommendations to the board about:
    - standards and requirements for training and certification in their trade
    - courses and examinations in their trade
    - apprenticeship and certification
    - designation of trades and occupations
    - regulations and orders under the Apprenticeship and Industry Training Act
- monitor the activities of local apprenticeship committees in their trade
- determine whether training of various kinds is equivalent to training provided in an apprenticeship program in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- consult with other committees under the Apprenticeship and Industry Training Act about apprenticeship programs, training and certification and facilitate cooperation between different trades and occupations
- consult with organizations, associations and people who have an interest in their trade and with employers and employees in their trade
- may participate in resolving certain disagreements between employers and employees
- carry out functions assigned by the board

Plumber PAC Members at the Time of Publication

Mr. R. Austerman	Calgary	Presiding Officer
Mr. R. Ballance	Edmonton	Employer
Mr. L. Cornwell	Edmonton	Employer
Mr. G. Doty	Edmonton	Employer
Mr. D. Gramson	High Level	Employer
Mr. R. Finch	Calgary	Employee
Mr. C. Radloff	Calgary	Employee
Mr. M. Badke	Edmonton	Employee

Alberta Government

Alberta Advanced Education and Technology works with industry, employer and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to apprentices and employers
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Technical Institutes and Colleges

The technical institutes and colleges are key participants in Alberta's apprenticeship and industry training system. They work with the board, industry committees and Alberta Advanced Education and Technology to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs. They develop lesson plans from the course outlines established by industry and provide technical training to apprentices.

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, employers, employees, apprentices and the public. Therefore, it is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment.

Alberta Apprenticeship and Industry Training Board Safety Policy

The Alberta Apprenticeship and Industry Training Board fully supports safe learning and working environments and encourages the teaching of proper safety procedures both within trade specific training and in the workplace.

Trade specific safety training is an integral component of technical training, while ongoing or general non-trade specific safety training remains the responsibility of the employer and the employee as required under workplace health and safety legislation.

Workplace Responsibilities

The employer is responsible for:

- training employees and apprentices in the safe use and operation of equipment
- providing and maintaining safety equipment, protective devices and clothing
- enforcing safe working procedures
- providing safeguards for machinery, equipment and tools
- observing all accident prevention regulations

The employee and apprentice are responsible for:

- working in accordance with the safety regulations pertaining to the job environment
- working in such a way as not to endanger themselves, fellow employees or apprentices

Workplace Health and Safety

A tradesperson is often exposed to more hazards than any other person in the work force and therefore should be familiar with and apply the Occupational Health and Safety Act, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Workplace Health and Safety (Alberta Employment, Immigration and Industry) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.worksafely.org

Technical Training

Apprenticeship technical training is delivered by the technical institutes and many colleges in the public post-secondary system throughout Alberta. The colleges and institutes are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All training providers place great emphasis on safe technical practices that complement safe workplace practices and help to develop a skilled, safe workforce.

The following institutions deliver Plumber apprenticeship technical training:

Northern Alberta Institute of Technology
Red Deer College
Northern Alberta Institute of Technology / Fairview College
Southern Alberta Institute of Technology
Medicine Hat College

Procedures for Recommending Revisions to the Course Outline

Advanced Education and Technology has prepared this course outline in partnership with the Plumber Provincial Apprenticeship Committee.

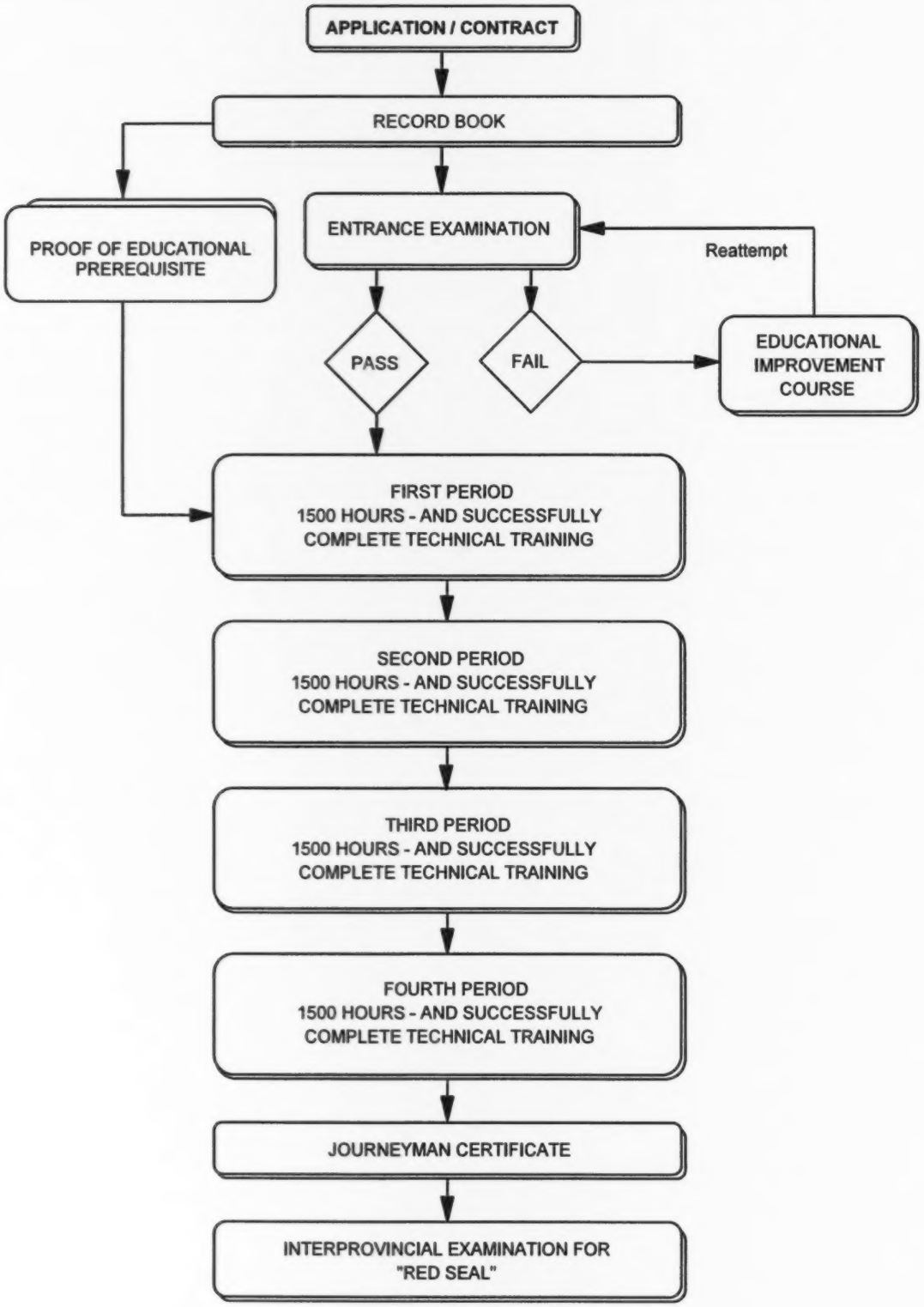
This course outline was approved on June 20, 2005 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

Plumber Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
Advanced Education and Technology
10th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used. Recommendations for change will be placed on the agenda for regular meetings of the Plumber Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification



Plumber Training Profile
FIRST PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

SAFETY AND WHMIS — **8 HOURS**

A	B
Safe work Practices 060101a — 6 Hours	Workplace Hazardous Materials Information System (WHMIS) 060101b — 2 Hours

SECTION TWO

TOOLS, EQUIPMENT AND MATERIALS — **52 HOURS**

A	B	C
Hand and Power Tools 060102a — 6 Hours	Explosive Actuated Tools Theory and Lab 060102b — 6 Hours	Iron Pipe and Fittings 060102c — 8 Hours
D	**E**	**F**
Copper Tube, Tubing and Fittings 060102d — 6 Hours	Welded and Flanged Piping 060102e — 4 Hours	Plastic Pipe and Fittings 060102f — 6 Hour
G	**H**	**I**
Cast Iron Fibreglass, Glass Lead, and Historic Piping 060102g — 6 Hours	Pipe Hangers 060102h — 4 Hours	Valves 060102i — 6 Hours

SECTION THREE

PLUMBING THEORY — **34 HOURS**

A	B	C
Introduction to Plumbing - Single Family Dwelling 060103a — 9 Hours	Building Drains and Sewers, Individual Vents and Roof Terminals 060103b — 6 Hours	Fixture Traps, Floor Drains, Cleanouts and Manholes 060103c — 6 Hours
D	**E**	
Plumbing Fixtures 060103d — 6 Hours	The Water Supply System 060103e — 7 Hours	

SECTION FOUR

HEATING — **24 HOURS**

A	B	C
Introduction and Definitions 060104a — 6 Hours	Boilers and Trim 060104b — 8 Hours	Hot Water Heating Systems 060104c — 6 Hours
D		
Heat Emission Units 060104d — 4 Hours		

SECTION FIVE

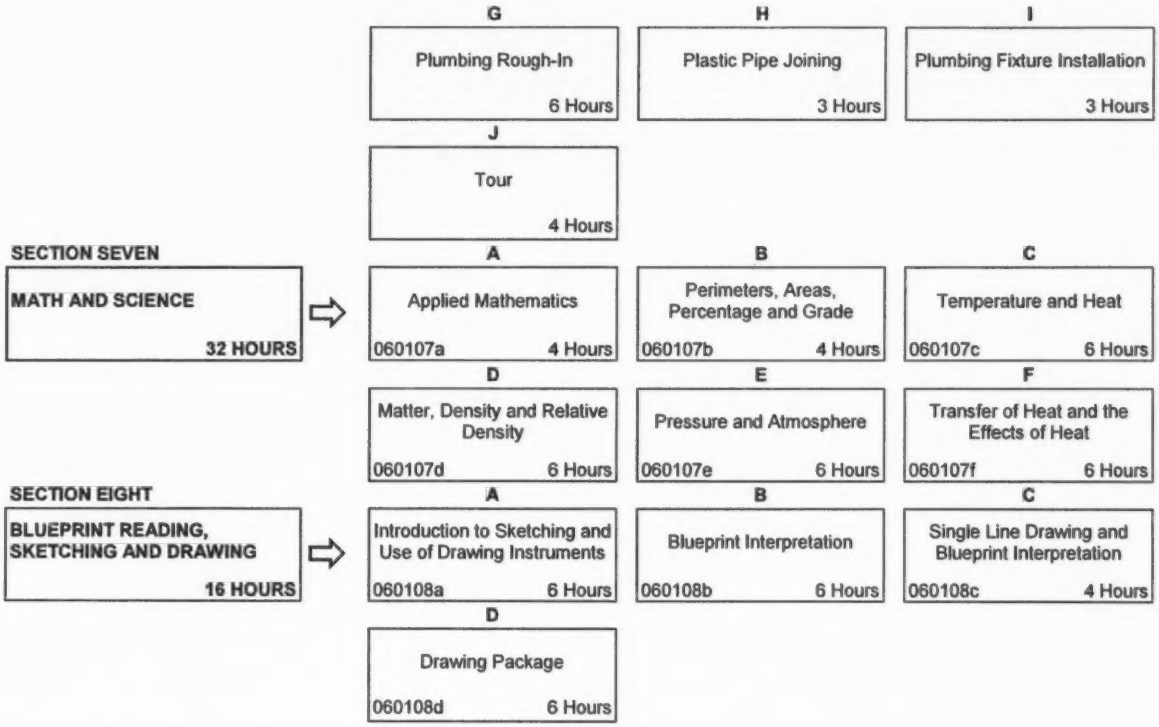
GAS THEORY — **34 HOURS**

A	B	C
Introduction to Gasfitting Fundamentals 060105a — 6 Hours	Introduction to Gasfitting Codes and Regulations 060105b — 8 Hours	Properties of Gases and Principles of Combustion 060105c — 7 Hours
D	**E**	
Measurement and Calculation of Pressure Drop 060105d — 7 Hours	Natural Draft Burner Adjustments and Gas Consumption 060105e — 6 Hours	

SECTION SIX

PRACTICAL APPLICATIONS — **40 HOURS**

A	B	C
Introduction to Oxyacetylene Equipment 060106a — 3 Hours	Introduction to Rigging 060106a — 6 Hours	Safe Use of Tools 3 Hours
D	**E**	**F**
Threaded Pipe Joining Techniques 6 Hours	Soldering 3 Hours	Flaring and Compression 3 Hours


G
Plumbing Rough-In
6 Hours
H
Plastic Pipe Joining
3 Hours
I
Plumbing Fixture Installation
3 Hours
J
Tour
4 Hours
SECTION SEVEN
MATH AND SCIENCE
32 HOURS
A
Applied Mathematics
060107a 4 Hours
B
Perimeters, Areas, Percentage and Grade
060107b 4 Hours
C
Temperature and Heat
060107c 6 Hours
D
Matter, Density and Relative Density
060107d 6 Hours
E
Pressure and Atmosphere
060107e 6 Hours
F
Transfer of Heat and the Effects of Heat
060107f 6 Hours
SECTION EIGHT
BLUEPRINT READING, SKETCHING AND DRAWING
16 HOURS
A
Introduction to Sketching and Use of Drawing Instruments
060108a 6 Hours
B
Blueprint Interpretation
060108b 6 Hours
C
Single Line Drawing and Blueprint Interpretation
060108c 4 Hours
D
Drawing Package
060108d 6 Hours

SECOND PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

FIRST YEAR REVIEW — **8 HOURS**

- A: Tools and Materials — 4 Hours
- B: Occupational Health and Safety and Fire Safety Control — 4 Hours

SECTION TWO

PLUMBING THEORY — **42 HOURS**

- A: Water Distribution, Flow and Water Heaters — 060202a — 8 Hours
- B: Dual Vents, Flat Vents and Residential Storm Drains — 060202b — 6 Hours
- C: Wet Venting of a Residential Bathroom Group — 060202c — 6 Hours
- D: Residential Drainage, Waste and Venting — 060202d — 6 Hours
- E: Commercial Wet Venting of One Bathroom Group — 060202e — 6 Hours
- F: Plumbing Fixtures, Dishwashers and Garbage Grinders — 060202f — 10 Hours

SECTION THREE

HYDRONIC HEATING — **32 HOURS**

- A: Boiler Installation, Operation and Troubleshooting — 060203a — 10 Hours
- B: Installation Procedures for Terminal Heating Units and Radiant Heating Panels — 060203b — 6 Hours
- C: Expansion Control in Hydronic Heating — 060203c — 6 Hours
- D: Basic Hydronic System Layout — 060203d — 10 Hours

SECTION FOUR

GASFITTING — **40 HOURS**

- A: Pipe Installation and Gas Line Sizing Regulation — 060204a — 3 Hours
- B: Low-Pressure Gas Line Sizing and Installation — 060204b — 7 Hours
- C: Pressure Regulators and Orifices — 060204c — 8 Hours
- D: Pilots, Pilot Burners, Thermocouples and Thermopiles — 060204d — 8 Hours
- E: Introduction to Flues, Draft Hoods and Vent Connections — 060204e — 8 Hours
- F: Introduction to Vents and Chimneys — 060204f — 6 Hours

SECTION FIVE

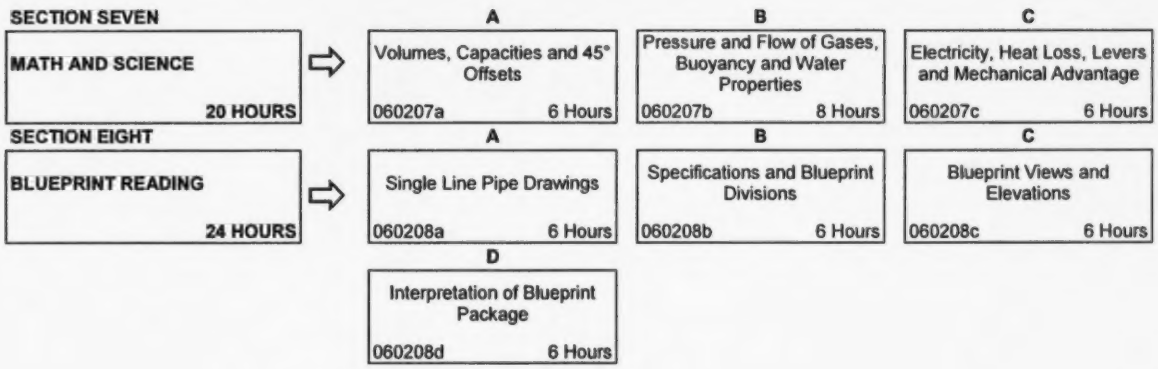
PIPE TRADES PRACTICAL APPLICATIONS — **50 HOURS**

- A: T-Drill, Brazing, Tube Bending and Grooved Pipe — 060205a — 12 Hours
- B: Rigging and Hoisting — 060205b — 8 Hours
- C: Fasteners and Drain Cleaning — 060205c — 6 Hours
- D: Valve Identification and Servicing — 3 Hours
- E: Residential Rough-in with Double Plumbing — 6 Hours
- F: Hot Water Boilers and Trim — 3 Hours
- G: Gas Line Installation — 6 Hours
- H: Tour — 6 Hours

SECTION SIX

PIPEFITTING AND WELDING — **24 HOURS**

- A: Welding Safety, Tools and Symbols — 060206a — 6 Hours
- B: Welding and Cutting Theory — 060206b — 6 Hours
- C: Bracket Project — 6 Hours
- D: Pipefitting Project — 6 Hours


SECTION SEVEN
MATH AND SCIENCE
20 HOURS
A
Volumes, Capacities and 45° Offsets
060207a 6 Hours
B
Pressure and Flow of Gases, Buoyancy and Water Properties
060207b 8 Hours
C
Electricity, Heat Loss, Levers and Mechanical Advantage
060207c 6 Hours
SECTION EIGHT
BLUEPRINT READING
24 HOURS
A
Single Line Pipe Drawings
060208a 6 Hours
B
Specifications and Blueprint Divisions
060208b 6 Hours
C
Blueprint Views and Elevations
060208c 6 Hours
D
Interpretation of Blueprint Package
060208d 6 Hours

THIRD PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

PRIVATE SEWAGE DISPOSAL SYSTEMS
18 HOURS

A	B	C
Introduction to Private Sewage Disposal Systems 060301a 4 Hours	Septic Tank With Effluent Chamber and Holding Tanks 060301b 6 Hours	Approved Effluent and Sewage Treatment Components 060301c 8 Hours

SECTION TWO

PLUMBING THEORY
66 HOURS

A	B	C
Residential Drainage Waste and Vents Including Sumps and Backwater Valves 060302a 6 Hours	Floor Drains, Gang Showers, Washing Machines and Circular Rainwater Leaders 060302b 8 Hours	Island Vent, Vent Stacks and Relief Vents Between DWV Stacks 060302c 8 Hours
D	**E**	**F**
Commercial Wet Vent Installation 060302d 6 Hours	Potable Water Distribution Systems 060302e 10 Hours	Water Heating Appliances and Hot Water Recirculation 060302f 6 Hours
G	**H**	**I**
Pressure Reducing Valves and Booster Pumps 060302g 4 Hours	Faucets and Flushometers 060302h 8 Hours	Plumbing Fixtures 060302i 10 Hours

SECTION THREE

HYDRONIC RADIANT HEATING
22 HOURS

A	B	C
Hydronic Radiant Heating and Heat Loss Calculations 060303a 6 Hours	Introduction to Hydronic Radiant Heating Design 060303b 12 Hours	Boiler Start-Up and Servicing 060303c 4 Hours

SECTION FOUR

GASFITTING THEORY AND LAB
64 HOURS

A	B	C
Sizing Chimneys and Flues 060304a 8 Hours	Air Supply 060304b 4 Hours	Domestic Gas Fired Appliances 060304c 8 Hours
D	**E**	**F**
Basic Electricity For Gas Appliances and Gas Controls 060304d 6 Hours	Electrical Circuits For Domestic Gas Appliances and Gas Controls 060304e 6 Hours	Gas and Electrical Controls Lab 060304f 8 Hours
G	**H**	**I**
Propane Cylinders and Vapourization 060304g 6 Hours	Domestic Appliance Installation and Servicing Lab (Including Mid and High Efficiency) 6 Hours	Appliance Gas Controls and Wiring Lab 12 Hours

SECTION FIVE

PRACTICAL APPLICATIONS
30 HOURS

A	B	C
Builders Level 060305a 4 Hours	Commercial Rough-In of Wet Vented Fixtures With Continuous and Relief Vents 4 Hours	Residential Rough-In 4 Hours
D	**E**	**F**
Faucet Service 4 Hours	Hot Tapping 060305a 2 Hours	Flush Valve Service Shop 4 Hours
G	**H**	
Parallel Piping Offsets 4 Hours	Tour 4 Hours	

SECTION SIX

TRADE MATHEMATICS AND SCIENCE
18 HOURS

A	B	C
Volumes, Capacities and Surface Areas 060306a 4 Hours	Square Roots, Piping Offsets and Fitting Allowances 060306b 6 Hours	Fixture Spacing 060306c 4 Hours

D
Grades and Elevations 060306d 4 Hours

SECTION SEVEN

BLUEPRINT READING SKETCHING AND DRAWING
24 HOURS

A	B	C
Residential DWV Sketching 060307a 6 Hours	Commercial DWV Sketching and Drawing 060307b 6 Hours	Applied Blueprint Reading 060307c 12 Hours

FOURTH PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

PRIVATE WATER SUPPLY AND WATER TREATMENT
34 HOURS

A	B	C
Introduction to Private Water Supply Systems 060401a 4 Hours	Pumps for Private Water Supply Systems 060401b 4 Hours	Private Water Supply Pressure System Components 06041c 4 Hours

D	E	F
Private Water Supply Pressure System Sizing 060401d 4 Hours	Introduction to Water Treatment 060401e 4 Hours	Impurities in Water 060401f 6 Hours

G
Methods of Treatment and Equipment Installation 060401g 8 Hours

SECTION TWO

SPECIAL APPLICATIONS
40 HOURS

A	B	C
Cross Connection Control Awareness 060402a 10 Hours	Specialty Water Distribution, Control Valves and Equipment 06042b 8 Hours	Introduction to Residential Fire Sprinkler Systems 060402c 4 Hours

D	E	F
Wet Standpipe and Dry Standpipe Fire Lines 060402d 4 Hours	Swimming Pools and Spas 06042e 4 Hours	Compressed Air Systems 06042f 4 Hours

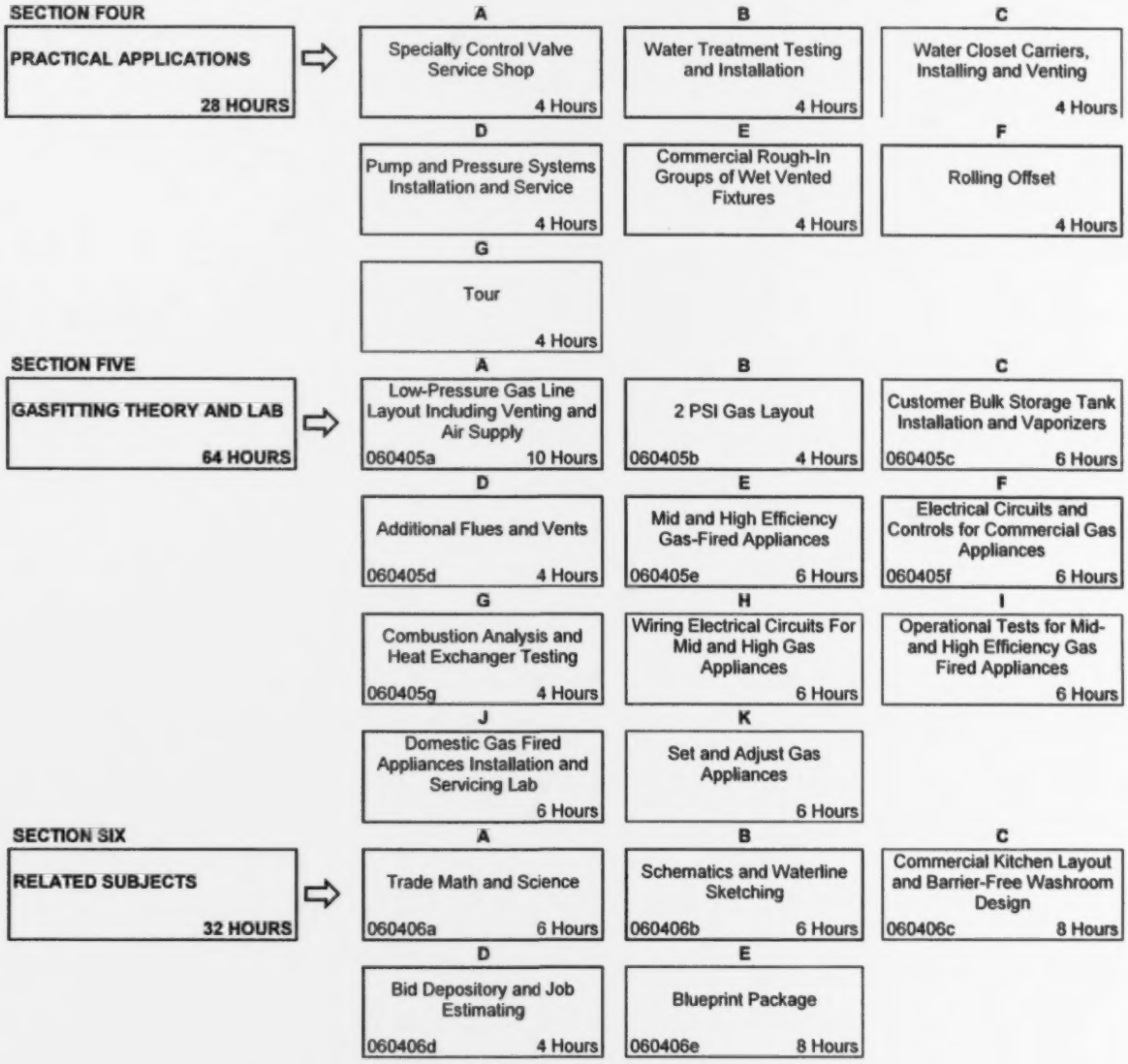
G	H
Medical Gas Piping 06042g 3 Hours	Lawn Irrigation 06042h 3 Hours

SECTION THREE

DRAIN WASTE AND VENTING
42 HOURS

A	B	C
Interceptors and Indirect Wastes 060403a 8 Hours	Sewage Sumps, Receiving Tanks and Dumping Stations 060403b 6 Hours	DWV, Water Distribution and Fixtures For Residential Installation 60403c 6 Hours

D	E
Specialty Plumbing Fixtures 060403d 12 Hours	Commercial Equipment Installation 060403e 10 Hours



NOTE: The hours stated are for guidance and should be adhered to as closely as possible. However, adjustments must be made for rate of apprentice learning, statutory holidays, registration and examinations for the training establishment and Apprenticeship and Industry Training.

FIRST PERIOD TECHNICAL TRAINING
PLUMBER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: ..... SAFETY AND WHMIS ..... 8 HOURS

A. Safe Work Practices (060101a) ..... 6 Hours

Outcome: ***Identify and examine legislation and workplace programs intended to promote safe work habits and prevent injuries and fires, and describe appropriate responses to accidents.***

1. Identify common hazards in the work place.
2. Identify hazards related to confined space entry.
3. Identify personal protective equipment and first aid certification for plumbers.
4. Identify fire hazards and methods of fire prevention.
5. Describe application of the Worker's Compensation Act.
6. Demonstrate an ability to locate and interpret sections of the Occupational Health and Safety Act, General Safety Regulations as they apply to plumbing.

B. Workplace Hazardous Materials Information System (WHMIS) (060101b) ..... 2 Hours

Outcome: ***Apply the requirements of WHMIS to the work site.***

1. Describe the three key elements of WHMIS.
2. Identify and interpret WHMIS hazard symbols and Material Safety Data Sheets (MSDS).

SECTION TWO: ..... TOOLS AND MATERIALS ..... 52 HOURS

A. Hand and Power Tools (060102a) ..... 6 Hours

Outcome: ***Select and use hand tools common to the pipe trades.***

1. Identify and explain hand tools used in the pipe trades.
2. Identify and explain power tools used in the pipe trades.
3. Select the correct tool and proper size for the desired task.
4. Describe proper maintenance and repair of common hand and power tools.
5. List and describe workmanship, safety and the correct operational procedures required when using common hand and power tools.
6. Identify General Safety Regulations pertaining to the operation of power and electrical tools.
7. Describe the operation, precautions and applications of freeze packs used in the pipe trades.

B. Explosive Actuated Tools (060101b) .....6 Hours

Outcome: ***Describe the operation and safely use explosive actuated tools.***

1. Differentiate between high and low velocity explosive actuated tools.
2. Describe explosive actuated tool power loads (low and high velocity), power load strength and safety requirements.
3. Describe explosive actuated tool fasteners, accessories and applications.
4. Assess base material suitability and related fastening requirements.
5. Describe explosive actuated system safety and firing procedure.
6. Perform tool maintenance and use an explosive actuated tool safely.

C. Iron Pipe and Fittings (060102c).....8 Hours

Outcome: ***Describe, install and service ferrous pipe and fittings.***

1. List and describe the composition of ferrous, alloyed and non-ferrous pipe.
2. List and describe pressure ratings, schedule number, sizing and finishes pertaining to ferrous pipe.
3. Identify applications and codes, regulations and manufacturers specifications pertaining to ferrous pipe.
4. Describe the proper procedure required to cut a pipe thread using various hand and power tools.
5. Calculate cut length for threaded pipe.
6. List and describe correct fabrication processes for threaded pipe.
7. Identify types, pressure ratings and symbols pertaining to threaded fittings.
8. Interpret codes and regulations pertaining to threaded pipe and fittings.

D. Copper Tube, Tubing and Fittings (060102d).....6 Hours

Outcome: ***Describe, install and service non-ferrous metal pipe and fittings.***

1. List and describe types, colour code, designations and pressure ratings used for tube and tubing.
2. List and describe fitting types, joining techniques and code interpretations used for tube and tubing.
3. Identify applications and codes, regulations and manufacturers specifications pertaining to solder copper tube.
4. List and describe application, code, and health and safety issues pertaining to various common solders and fluxes.
5. List and describe fabrication processes for soft solder joints including tools and heating process.
6. Describe electric resistance soldering.

E. Welded and Flanged Piping (060102e) .....4 Hours

Outcome: ***Describe the fabrication process, installation and service of welded and flanged pipe and fittings.***

1. List and describe types, markings, designations and pressure ratings and code interpretations of welded pipe fittings.
2. List and describe fabrication processes for welded pipe and fittings to the tack stage.
3. List and describe types, markings, designations, temperature and pressure ratings and code interpretations of flanged fittings and gaskets.
4. List and describe gasket preparation and proper joining techniques for a flanged joint.

F. Plastic Pipe and Fittings (060102f).....6 Hours

Outcome: ***Describe, install and service non-metallic pipe and fittings.***

1. List and describe approved types, colour coding, applications and code considerations for plastic pipe and fittings.
2. Identify safety practices required for various fabrication techniques.
3. List and describe fabrication processes for solvent welding plastic pipe.
4. List and describe fabrication processes for plastic pipe using mechanical joints.
5. List and describe fabrication processes for bell end joints.
6. List and describe fabrication processes for plastic pipe using thermal fusion and electric resistance welding.

G. Cast Iron, Fibreglass, Glass, Lead and Historic Piping (060102g) .....6 Hours

Outcome: ***Describe, install and service cast iron, fibreglass, glass, lead and once popular piping materials.***

1. Identify approved grades, applications and code considerations for cast iron pipe and fittings.
2. List and describe fabrication processes for cast iron piping.
3. Differentiate between cast iron pipe and cast iron water service pipe in regards to application, installation and code requirements.
4. List and describe types, grades, applications, fabrication processes and code considerations for glass pipe and fittings.
5. List and describe grades, applications, fabrication processes and code considerations for fibreglass pipe and fittings.
6. List and describe grades, applications, fabrication processes and code considerations for lead pipe and fittings and sheet material.
7. List and describe grades, applications, fabrication processes and code considerations for historic piping materials.

H. Pipe Hangers (060102h) .....4 Hours

Outcome: ***Support pipe and fittings above ground.***

1. Identify pipe, tube and tubing hangers used in the plumbing industry.
2. Identify usage of various hangers and protective coatings that may be applied.
3. Describe installation techniques for various hangers.
4. List and describe code requirements for hangers.

I. Valves (060102i) ..... 6 Hours

Outcome: ***Install and service valves.***

1. Identify various styles and types of valves.
2. Describe major design variations and applications of various valves.
3. List and describe common maintenance problems and correct service and maintenance procedures for valves.
4. Interpret codes, regulations and manufacturer's instruction pertaining to valves and installation.

SECTION THREE: ..... PLUMBING THEORY 34HOURS

A. Introduction to Plumbing - Single Family Dwelling (060103a) ..... 9 Hours

Outcome: ***When you have completed this module you will be able to describe the operation of the apprenticeship system and the role of the Local Apprenticeship Committee (LAC) and the Provincial Apprenticeship Committee (PAC) within the system. You will be familiar with the trade terminology and tool requirements as applicable to single-family residential construction and be able to sketch, label and size, referencing the National Plumbing Code of Canada, a simple residential plumbing system.***

1. Discuss historical foundations, career opportunities, LAC-PAC functions and Trade regulations pertaining to pipe trades.
2. List and describe definitions pertaining to the pipe trades.
3. Locate and identify definitions in the National Plumbing Code that pertain to first period.
4. List and describe terminology that applies to a plumbing system in a detached single-family dwelling.
5. Identify and describe the operation of a simple stack venting system.
6. List and describe required tools and correct installation procedures for the DWV plumbing systems in a detached single family dwelling.
7. List and describe the correct selection and installation of fittings and pipe above and below ground.
8. Layout, sketch and size (minimum size) of basic DWV systems.
9. Interpret code requirements and identify testing procedures for DWV systems.

B. Building Drains and Sewers, Individual Vents and Roof Terminals (060103b) ..... 6 Hours

Outcome: ***Install and service drainage and venting systems in accordance with the National Plumbing Code of Canada, plumbing bulletins and/or manufacturer's specifications.***

1. List and describe definitions and installation procedures pertaining to individual vents, branch vents, fixture drains and continuous waste and vent systems.
2. Lay out, sketch, label and size (minimum) isometric drawings of individually vented traps, applying pertinent code requirements.
3. List and describe common terminology and installation practices applying to building drains and building sewers.
4. Interpret plumbing code requirements pertaining to the installation and testing of building drains and building sewers.
5. List and describe common terminology and installation practices applying to roof terminals and flashing.

6. Interpret plumbing code requirements pertaining to the installation of roof terminals and flashing.

C. Fixture Traps, Floor Drains, Cleanouts and Manholes (060103c).....6 Hours

Outcome: ***Install and service drainage and venting systems in accordance with the National Plumbing Code of Canada, plumbing bulletins and manufacturer's specifications.***

1. Describe the function of plumbing traps.
2. List and describe definitions and installation procedures pertaining to fixture traps.
3. Describe terminology and sizing as it applies to floor drains.
4. List and describe installation procedures and code requirements pertaining to floor drains.
5. Describe terminology as it applies to cleanouts and manholes.
6. List and describe materials, installation procedures and code requirements pertaining to cleanouts and manholes.

D. Plumbing Fixtures (060103d).....6 Hours

Outcome: ***Install and service plumbing trim and fixtures in accordance with the National Plumbing Code, plumbing bulletins and manufacturer specifications.***

1. Define common terminology associated with plumbing fixtures.
2. Identify common plumbing fixtures with regard to types, styles and manufacturers.
3. List and describe common fixture trim requirements and state minimum supply connection size and fixture unit rating.
4. List and describe approved materials and installation procedures pertaining to plumbing fixtures.
5. List and describe the operation and service problems of all components within a water closet tank.
6. Interpret code requirements pertaining to plumbing fixtures.

E. The Water Supply System (060103e) .....7 Hours

Outcome: ***Install and service cold and hot potable water systems in accordance with the National Plumbing Code, plumbing bulletins and/or manufacturer specifications.***

1. List and describe common terminology associated with the water cycle.
2. Describe and identify parts of a municipal water distribution system.
3. Define terminology associated with potable water supply systems.
4. List and identify names and AWWA requirements for all parts of a water service pipe.
5. Sketch and identify parts of the internal hot and cold distribution system.
6. List and describe proper installation procedures for potable water supply and service piping indicating minimum sizing using the rule of thumb method.
7. Interpret code and other legislated requirements pertaining to potable water supply and distribution systems.

SECTION FOUR: ..... HEATING ..... 24 HOURS

A. Introduction and Definitions (060104a) ..... 6 Hours

Outcome: ***Install and service hot water heating for a single family dwelling, including boilers, trim (hot water and low pressure steam), two pipe supply systems and terminal heating systems in accordance with the applicable codes and manufacturers' specifications.***

1. List and describe the scope of the Steamfitter - Pipefitter industry including historical foundations and career opportunities.
2. Read and interpret the Alberta Trade Regulations for the Steamfitter - Pipefitter trade.
3. List and describe definitions pertaining to boilers.
4. List and describe terminology pertaining to hot water and low pressure steam boiler trim.
5. List and describe terminology pertaining to terminal heat units.
6. Describe principles of heat transfer.

B. Boilers and Trim (060104b) ..... 8 Hours

Outcome: ***Identify boilers and trim for hot water and low pressure steam applications.***

1. Describe boiler ratings and differences between low and high-pressure boilers.
2. List and describe the materials that are used to construct boilers.
3. Identify and describe the operation of various boilers.
4. List and describe advantages and disadvantages of various boilers.
5. List and identify all parts and components of boiler trim and safety controls for a hot water boiler.
6. Describe basic functions of components of boiler trim.
7. Locate and identify components and trim on a drawing or model.
8. List and describe the trim on a low-pressure steam boiler and the differences between trim on the LP steam boiler and a hot water boiler.

C. Hot Water Heating Systems (060104c) ..... 6 Hours

Outcome: ***Install and service hot water heating for a single family dwelling, including boilers, trim (hot water and low pressure steam), two-pipe supply systems and terminal heating systems in accordance with applicable codes and manufacturers' specifications.***

1. List and identify various materials that are installed in hot water heating systems.
2. Describe proper layout and operation of various systems including advantages and disadvantages of each system.
3. List and identify all component parts of various piping systems.
4. Describe how to eliminate air from the system.
5. Identify locations and operation of various air vents.
6. Describe the effects of convection and how water is circulated in a modern system.

D. Heat Emission Units (060104d) .....4 Hours

Outcome: ***Install and service hot water heating for a single family dwelling, including boilers, trim (hot water and low-pressure steam), two-pipe supply systems and terminal heating systems in accordance with applicable codes and manufacturers' specifications.***

1. Identify the methods of heat emission that would be utilized in various systems.
2. Identify various heat emission units.
3. List and identify various components within convectors.
4. Describe the proper installation practices in regards to fin vectors and baseboard radiation.

SECTION FIVE:..... GAS THEORY .....34 HOURS

A. Introduction to Gasfitting Fundamentals (060105a).....6 Hours

Outcome: ***Explain and identify basic gas fundamentals and the purpose, legal status and organization of C.G.A. Gas Codes B149.1-00, B149.2-00, and the Gas Bulletins.***

1. Describe and interpret historical foundations, career opportunities and Trade Regulations for the trade of gasfitter.
2. Describe production, distribution and storage of natural gas.
3. Describe production, distribution and storage of propane gas.
4. State regulations pertaining to the general requirements of the gasfitter trade.
5. Identify regulations pertaining to the gasfitter trade.
6. Interpret regulations pertaining to the gasfitter trade.

B. Introduction to Gasfitting Codes and Regulations (060105b).....8 Hours

Outcome: ***Identify and apply rules pertaining to the installation of piping and tubing systems for various conditions of use in accordance with the C.G.A. Gas Codes B149.1-00 (Section 1-3), B149.2-00, and the GAS Bulletins.***

1. List and describe the regulations contained in the scope section of the code, amendments to the code and the regulations pertaining to the installer's responsibilities.
2. Use the definitions and abbreviations as found within the B149.1-00 and B149.2-00 gas codes.
3. State the regulations contained in the B149.1-00 and B149.2-00 gas codes and the Plumbing and Gas Safety Services Bulletin pertaining to installation of piping and fittings.
4. State the regulations contained in the B149.1-00 and B149.2-00 gas codes and the Plumbing and Gas Safety Services Bulletin pertaining to testing of piping and fittings.
5. State the regulations contained in the B149.1.00 and B149.2-00 gas codes and the Plumbing and Gas Safety Services Bulletin pertaining to purging of piping and fittings.
6. Describe correct safety practices to be used pertaining to installation of piping and fittings.
7. Describe correct safety practices to be used pertaining to the testing of piping and fittings.
8. Describe correct safety practices to be used pertaining to purging of piping and fittings.

C. Properties of Gases and Principles of Combustion (060105c) .....7 Hours

Outcome: ***Explain basic gas fundamentals.***

1. State chemical formulas as required for the gasfitting trade.
2. State relative densities, liquefaction ratios and heating values of gases in both imperial and metric units.
3. Calculate various trade-related problems using properties of gases.
4. Identify definitions specific to combustion.
5. Explain the principles of combustion as a chemical change.
6. List and describe the products of complete and incomplete combustion and requirements for combustion air.
7. Describe flame adjustment techniques and correct safety practices when adjusting gas-fired equipment.

D. Measurement and Calculation of Pressure Drop (060105d).....7 Hours

Outcome: ***Define and calculate pressure drop in a gas piping system by using manometers and mechanical pressure 1gauges.***

1. Identify types and proper operating procedures of imperial and metric manometers and mechanical gauges used in the gasfitting trade.
2. Use and describe safe operating procedures and code requirements for using manometers and mechanical gauges to measure gas pressures and for gas leak testing.
3. Define and explain the terms pressure, force and pressure drop as they pertain to the gasfitting trade.
4. Identify factors that effect pressure drop in a piping system.
5. Calculate simple problems based on pressure drop within piping systems.

E. Natural Draft Burner Adjustments and Gas Consumption (060105e) .....6 Hours

Outcome: ***Install and adjust various pressure controls and gas-fired burners using rating plates, gas meters, manometers and mechanical gauges to calculate consumption for gas-fired appliances.***

1. Determine proper appliance settings using rating plates, altitude designation and listed approval agencies.
2. List and describe requirements from the B149.1-00 and B149.2-00 gas codes and the Plumbing and Gas Safety Services Bulletin pertaining to gas appliance adjustments and installer responsibilities.
3. List and define parts of a burner and common burner terminology.
4. Adjust and measure manifold pressures to determine gas consumption of burners in both imperial and metric units.
5. Identify and adjust various orifices and manifold pressures to determine gas consumption.
6. Identify and determine meter dials and meter indexes in both metric and imperial units.
7. Explain the principles of low pressure gas meter clocking.
8. Calculate gas consumption using timed meter readings.

SECTION SIX: .....PRACTICAL APPLICATIONS..... 40 HOURS

A. Introduction to Oxyacetylene Equipment (060106a) .....3 Hours

Outcome: ***Identify the correct procedure for balancing an oxyacetylene torch.***

1. Identify and explain all the various components and safe work practices associated with the use of oxyacetylene welding equipment.
2. Demonstrate the proper technique for balancing a torch.
3. Describe the various types, parts, care and maintenance of natural and synthetic rope.

B. Introduction to Rigging (060106a).....6 Hours

Outcome: ***Identify types of rope and various rigging components, and tie basic knots and hitches.***

1. Describe the various types, parts, care and maintenance of natural and synthetic rope.
2. Identify, describe and demonstrate the proper procedure for tying popular knots and hitches including:
   a) square knot
   b) round turn and half hitch
   c) clover hitch
   d) timber hitch
   e) bowline
   f) sheet bend
3. Describe the various types, parts and care and maintenance of wire rope.
4. Recognize and name differences between chain falls, come-a-longs, tirfors and snatch blocks.

C. Safe Use of Tools.....3 Hours

Outcome: ***Select and use hand tools common to the pipe trades.***

1. Identify and explain the use of hand and power tools used in the pipe trades.
2. Select the correct hand or power tool for the desired task.
3. Demonstrate proper maintenance and repair procedures of common hand and power tools.
4. Demonstrate proper workmanship, safety and correct operational procedures required when using common hand and power tools.

D. Threaded Pipe Joining Techniques .....6 Hours

Outcome: ***Thread pipe to specific requirements and dimensions.***

1. Select the required tools and materials for the project.
2. Adjust and set dies for correct depth of thread.
3. Measure, mark, cut, ream, thread and safely assemble project to correct dimensions.
4. Hydro-test the project to required pressure.

E. Soldering.....3 Hours

Outcome: ***Solder copper tube to specific requirements and dimensions.***

1. Select the required tools and materials for the project.
2. Measure, mark, cut, ream, clean, flux and safely assemble project to correct dimensions.
3. Solder project using correct filler materials.
4. Hydro-test the project to required pressure.

F. Flaring and Compression.....3 Hours

Outcome: ***Assemble tubing using flaring and compression to specific requirements and dimensions.***

1. Select the required tools and materials for the project.
2. Measure, mark, cut, ream, flare (or compression) and safely assemble project to correct dimensions.
3. Hydro-test the project to required pressure.

G. Plumbing Rough-in.....6 Hours

Outcome: ***Rough-in DWV for a single family dwelling, to specific requirements and dimensions, serving the following fixtures: kitchen sink, water closet, lavatory, bath tub, laundry stand pipe and floor drain.***

1. Select the required tools and materials for the project.
2. Layout, sketch and size with reference to current plumbing code and standards.
3. Measure, mark, cut and safely install DWV with correct grades.
4. Support piping to code requirements.
5. Test the project.

H. Plastic Pipe Joining.....3 Hours

Outcome: ***Join various types of plastic pipe to specific requirements and dimensions.***

1. Select the required tools and materials for the project.
2. Measure, mark, cut and assemble plastic pipe to prescribed requirements.
3. Safely join pipe using various methods with reference to code and manufacturer's specifications.
4. Hydro-test the project.

I. Plumbing Fixture Installation.....3 Hours

Outcome: ***Install plumbing fixtures to specific requirements and dimensions.***

1. Select the required tools and materials for the project.
2. With reference to rough-in book lay-out the project.
3. Safely install the fixtures with reference to code and manufacturer's specifications.

J. Tour ..... 4 Hours

Outcome: ***Tour plumbing and heating wholesale.***

1. Identify inventory control methods.
2. Identify the varied selection of materials used in the pipe trades.

SECTION SEVEN: ..... MATH AND SCIENCE ..... 32 HOURS

A. Applied Mathematics (060107a) ..... 4 Hours

Outcome: ***Implement basic mathematical skills relevant to the trade, utilizing metric and imperial measurements.***

1. Describe the operation of a basic calculator.
2. Perform basic arithmetic calculations using whole numbers, fractions and decimals with the aid of a calculator.
3. Perform number conversions using whole numbers, fractions and decimals.
4. Perform measurement conversions using whole numbers, fractions and decimals.

B. Perimeters, Areas, Percentage and Grade (060107b) ..... 4 Hours

Outcome: ***Solve mathematical problems involving perimeters, areas, percentage and grade.***

1. State and apply formulas for calculating perimeters of a rectangle, triangle and a circle.
2. State and apply formulas for calculating areas of regular-shaped prisms.
3. State and apply the formula for calculating percentages.
4. Calculate grades in both percentage and fraction per foot.

C. Temperature and Heat (060107c) ..... 6 Hours

Outcome: ***Implement basic heat calculations relevant to the trade, utilizing both metric and imperial values.***

1. Perform temperature conversion calculations.
2. Recall and state the specific heat values of water and air.
3. Define latent heat and state the latent heat values for water, ice, steam and propane.
4. Calculate sensible and latent heat values.

D. Matter, Density and Relative Density (060107d) ..... 6 Hours

Outcome: ***Define terminology related to matter and define and calculate densities and relative densities.***

1. Define and explain the terms matter, element, compound and mixture and identify the three states of matter.
2. Define and explain adhesion, cohesion, surface tension and capillarity.
3. Define and explain density and calculate density, mass and volume of substances.
4. Define and explain relative density and calculate mass, volume and density of substances.

E. Pressure and Atmosphere (060107e).....6 Hours

Outcome: ***Utilize standard science fundamentals that are relevant to the plumbing trade, applying both metric and imperial values.***

1. Define and explain the terms pressure and force.
2. State the six principles of hydrostatic pressure.
3. State pressure constants used for calculating pressures.
4. Perform pressure and force calculations in both imperial and metric units.
5. Describe atmospheric pressure and the effect of altitude.
6. Perform calculations to convert pressures from gauge to absolute.

F. Transfer of Heat and the Effects of Heat (060107f) .....6 Hours

Outcome: ***Describe the heat transfer process and apply to relative pipe trades.***

1. Identify and explain the three methods of heat transfer.
2. Define and explain the principles of expansion and contraction.
3. Perform calculations for linear expansion using coefficient of expansion tables.
4. Identify useful and detrimental effects of expansion and contraction.

SECTION EIGHT:..... BLUEPRINT READING, SKETCHING AND DRAWING .....16 HOURS

A. Introduction to Sketching and Drawing (060108a) .....6 Hours

Outcome: ***Draw and interpret basic orthographic drawings.***

1. Identify and explain the use of drafting equipment.
2. Identify and locate typical lines found on a blueprint typical of a three bedroom single family dwelling.
3. Identify the three basic views of an orthographic projection.
4. Draw and label the three basic views of an orthographic drawing.

B. Blueprint Interpretation (060108b) .....6 Hours

Outcome: ***Interpret blueprints and use a scale to determine correct dimensions in metric and imperial values.***

1. List and explain usage of typical scales.
2. Identify and interpret architectural dimensions with the aid of a scale rule.
3. Identify and explain typical symbols found on construction blueprints.
4. List and describe common piping symbols.
5. Identify sections of a simple object.
6. Draw sections of a simple object.

C. Single Line Drawing and Blueprint Interpretation (060108c) .....4 Hours

Outcome: ***Draw and label single line isometric pipe drawings and interpret symbols and specifications from a blueprint of a three bedroom single family dwelling.***

1. Draw and label orthographic single-line piping drawings and conversion to isometric drawings containing 90° elbows and tees.
2. Draw and label isometric single-line piping drawings containing 90° elbows and tees.
3. Interpret symbols and specifications on blueprints.
4. Interpret blueprints of a typical three bedroom single-family dwelling including views and elevations of a building.

D. Drawing Package (060108d).....0 Hours

Outcome: ***Correctly read and interpret blueprints contained in the package in conjunction to ILM 061008b.***

1. Identify drawings in the drawing package.
2. Interpret symbols used in a typical detached three bedroom single family dwelling.
3. Interpret specifications on blueprints.
4. Interpret a typical single dwelling residential site plan.
5. Interpret blue used in a typical detached three bedroom single family dwelling.

SECOND PERIOD TECHNICAL TRAINING
PLUMBER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... FIRST YEAR REVIEW ..... 8 HOURS

A. Tools and Material ..... 4 Hours

Outcome: ***Review tools and material from first period.***

1. Identify and explain safety requirements associated with hand and power tools used in the pipe trades.
2. Identify and explain common materials used in the plumber trade.
3. List and explain the applications of various materials used in the plumber trade.
4. List and explain joining methods of pipes and fittings used in the plumber trade.

B. Occupational Health and Safety and Fire Safety Control ..... 4 Hours

Outcome: ***Apply and promote safe work practices and fire safety control.***

1. Review common work place hazards.
2. Identify personal protective equipment.
3. Identify fire hazards and methods of fire prevention.
4. Demonstrate an ability to locate and interpret sections of the Occupational Health and Safety Act, General Safety Regulations.

SECTION TWO:..... PLUMBING THEORY ..... 42 HOURS

A. Water Distribution Flow and Water Heaters (060202a) ..... 8 Hours

Outcome: ***Install and service water distribution systems and hot water tanks, including testing of the system in a residential building according to the National Plumbing Code of Canada.***

1. Interpret the National Plumbing Code requirements pertaining to the water distribution system in a building including testing.
2. State the minimum and maximum pressures within a water distribution system.
3. List material requirements including water meters and safe and correct installation procedures for hot and cold water distribution systems.
4. Sketch and size hot and cold water distribution piping for a house using appropriate tables.
5. List and describe the various means by which domestic water tanks may be heated.
6. Describe the operation of storage and instantaneous water heaters.
7. List and describe safety components required with gas fired and electrically heated hot water tanks.
8. State capacities and code requirements for hot water tanks.

B. Dual Vents, Flat Vents and Residential Storm Drainage (060202b) ..... 6 Hours

Outcome: ***Install and service residential drainage and venting systems and residential storm drainage systems.***

1. Describe a dual vent and identify correct installation of dual vents.
2. Interpret plumbing code requirements and correctly size dual vents.
3. Describe a flat vent and identify usage, installation and alternatives to a flat vent.
4. Interpret plumbing code requirements and correctly size flat vents.
5. List and describe terminology that applies to residential storm drainage systems including weeping tile connections and sumps.
6. Interpret plumbing code requirements and state minimum size for residential storm drainage systems.

C. Wet Venting of a Residential Bathroom Group (060202c) ..... 6 Hours

Outcome: ***Install and service residential drainage and venting systems.***

1. Define the term wet vent.
2. Identify the wet vent portion of a vet vented group.
3. Identify correct installation techniques for horizontal and vertical wet vents.
4. Identify tables for sizing wet vents.
5. Size and lay out various vented bathroom groups.
6. Interpret plumbing code requirements for the correct installation and sizing of wet vents.

D. Residential Drainage, Waste and Venting (060202d) ..... 6 Hours

Outcome ***Apply rules pertaining to the installation of drainage and venting systems for various conditions of use.***

1. List and identify correct installation procedures for DWV systems.
2. List and identify methods of controlling expansion in DWV systems.
3. Identify various sizing tables and correctly size a system.
4. Layout and sketch various DWV systems for residences that include one wet vented group of fixtures.
5. Develop a material list for a residential DWV system.
6. Interpret plumbing code requirements for correct installation and testing of DWV systems.

E. Commercial Wet Venting of One Bathroom Group (060202e) ..... 6 Hours

1. Define terminology associated with various groups of wet vented fixtures in a commercial building.
2. List and describe correct installation techniques for horizontal wet venting.
3. Identify various components that form a horizontal wet vented group.
4. Sketch in isometric style and layout various combinations of wet vented groups of not more than eight wet vented fixtures with not more than six fixture units passing the lowest point of connection.
5. Layout, sketch and correctly size various DWV systems for residences that include one vented group of fixtures.

6. Interpret plumbing code requirements for the correct installation and testing of a wet vented system.

F. Plumbing Fixtures, Dishwashers and Garbage Grinders (060202f) ..... 10 Hours

Outcome: ***Install and service residential plumbing fixtures, trim and appliances, including the garbage grinders and dishwashers.***

1. Define terminology associated with various residential and commercial plumbing fixtures, garbage grinders, dishwashers, domestic clothes washers, service sinks, mop sinks, shower stalls and shower strainers with membranes.
2. List the fixture unit rating for the fixtures listed in objective one including water and waste connection size requirements.
3. Describe construction materials for plumbing fixtures for residential and commercial applications.
4. List and describe different types of garbage grinders.
5. Describe correct installation of fixtures including the use of a rough-in Book.
6. List and describe fixture trim required for each of the fixtures listed in objective one.
7. Describe correct installation of dishwashers including water supply.
8. Describe proper drainage and venting requirements for garbage grinders and dishwashers.
9. Describe proper safety precautions when working with residential and commercial fixtures. (Examples: sharp edges, weight, electrical precautions, awkward locations).
10. Interpret plumbing code requirements for fixtures and appliances.

SECTION THREE: ..... HYDRONIC HEATING ..... 32 HOURS

A. Boiler Installation, Operation and Troubleshooting (060203a) ..... 10 Hours

Outcome: ***Install and service hot water heating boilers.***

1. Describe the types and uses of boilers found in small commercial and apartment applications.
2. State and list installation and testing procedures for boilers.
3. Identify, describe and solve common service problems associated with boilers.
4. Identify, describe and solve common service problems associated with systems.
5. List the trim components required for the operation of a hydronic heating system.
6. Identify the function of trim components required for the operation of a hydronic heating system.
7. Describe the function of each trim component as it is related to the overall operation of a hydronic heating system.
8. State, when, how and where a low water cut-off is installed and how it operates.

B. Installation Procedures for Terminal Heating Units and Radiant Heating Panels (060203b) ..6 Hours

Outcome: ***Install and service residential and commercial hot water heat transfer units, including radiant ceiling panels.***

1. Identify the parts of a residential baseboard hot water heating system including zones, wild loop and a unit heater for a garage.
2. List and describe the correct installation techniques for various terminal heating units.
3. Define radiation and list and describe the common types and styles of radiant ceiling panels.
4. List and describe installation techniques for radiant ceiling panels and associated trim components.

C. Expansion Control in Hydronic Heating (060203c) ..... 6 Hours

Outcome: ***Install and service a residential hot water two-pipe heating system.***

1. List and describe methods of controlling expansion and state the reason why control is necessary.
2. List and describe placement of anchors, guides and expansion control devices.
3. Calculate the expansion of a typical pipe installation.
4. Identify problems due to improper expansion control.

D. Basic Hydronic System Layout (060203d) ..... 10 Hours

Outcome: ***Install and service a residential hot water two-pipe heating system.***

1. Given heat loss for a total building, describe procedure and calculate the heat loss for one room of a single-family dwelling.
2. List, describe and select baseboard radiation for the residence based upon the calculated heat loss using the standard 20°F temperature drop.
3. Describe the method used to correctly size the boiler and identify correct start-up procedures.
4. Describe the method used to correctly size piping, expansion tank and pump.
5. Identify code requirements for hydronic heating systems.
6. Describe proper installation procedure and develop a material list.

SECTION FOUR: ..... GASFITTING ..... 40 HOURS

A. Pipe Installation and Gas Line Sizing Regulations (060204a) ..... 3 Hours

Outcome: ***Apply rules pertaining to the installation of piping and tubing systems for various conditions of use.***

1. Explain the regulations pertaining to the installation of gas line piping from the B149.1-00 and Standata that relate to minimum and maximum pipe sizes from sizing tables.
2. Explain regulations pertaining to sizing various types of piping material from the B149.1-00 that relate to minimum and maximum pipe sizes and regulations over-ruling sizes determined from sizing tables.
3. Calculate hanger spacing and requirements for different types and sizes of gas lines.

B. Low-Pressure Gas Line Sizing and Installation (060204b)..... 7 Hours

Outcome: ***Install and service pipe, tubing and fittings on low pressure and 2-psi gas lines.***

1. Determine the type of gas being used.
2. Examine layout of gas line in building and determine longest run of gas piping.
3. Determine volume of gas being consumed by individual appliances and gas delivery requirements for each section of the gas line.
4. Correctly size gas lines using a gas line-sizing table.
5. Correctly size gas lines for various installations.
6. Describe safe procedure for leak testing and purging of gas lines.
7. Describe types of gas pressure measurement and pressure drop.

C. Pressure Regulators and Orifices (060204c)..... 8 Hours

Outcome: ***Install and service various types of gas pressure controls and burner orifices and adjust gas line pressures.***

1. Describe types, operating principles and applications of various gas pressure regulators.
2. Identify various regulator sizing tables and list and describe correct installation procedures for various regulators.
3. List and describe maintenance procedures for various regulators.
4. List some common pressure regulator problems and describe and apply corrective procedures.
5. Identify various types of orifices.
6. Use orifice-sizing charts to determine orifice sizing for specific gas consumption and pressure in both metric and imperial units.
7. Select the correct type of orifice and demonstrate drilling of an orifice to correct size using appropriate methods.
8. Demonstrate proper procedure for testing of orifice, adjust manifold pressure if necessary and clock meter to determine accuracy.

D. Pilots, Pilot Burners, Thermocouples and Thermopiles (060204d)..... 8 Hours

Outcome: ***Identify and service pilots, pilot burners, thermocouples and thermopiles.***

1. List and describe common pilot burner types and terminology.
2. List and describe the characteristics of pilot burners and identify parts of aerated and non-aerated pilot burners.
3. State the primary purpose of a gas pilot and describe burner ignition tests performed on all pilots.
4. List and describe operating principles of thermocouples and thermopiles.
5. List and describe the operation tests performed on proven pilots energizing a thermocouple.
6. List and describe methods of installing thermocouples and thermopiles on standard circuits.
7. List and describe operational test performed on thermocouples and thermopiles.
8. List and describe diagnostic tests for thermocouples and state major causes for thermocouple failures.

E. Introduction to Flues, Draft Hoods and Vent Connections (060204e) ..... 8 Hours

Outcome: ***Install and service draft hoods and vent connectors.***

1. Define terminology pertaining to flues and draft control devices.
2. Identify and describe flue collars and common types of draft hoods including correct installation procedures.
3. Explain regulations pertaining to the sizing, installation and use of draft hoods on gas burning appliances as listed in the B149.1-00 and Standata.
4. Describe correct sizing and installation procedures for single and double acting barometric dampers.
5. Explain regulations pertaining to the selection, sizing and installation of draft control devices as specified in the B149.1-00 code and Standata.
6. List, define and describe vent connectors and proper installation techniques.
7. Explain regulations pertaining to vent connectors as listed in the B149.1-00 and Standata.
8. Size vent connectors using minimum size rule.

F. Introduction to Vents and Chimneys (060204f) ..... 6 Hours

Outcome: ***Install and service vents and chimneys.***

1. List and describe venting principles and application of various vents for gas applications.
2. List and describe correct sizing and installation procedures for vents used on gas appliances.
3. Explain regulations pertaining to vents as listed in the B149.1-00 gas code and Standata.
4. List and describe various chimneys and application for gas and dual fuel appliances.
5. List and describe correct sizing and installation procedures for chimneys used for gas and dual fuel appliances.
6. Explain regulations pertaining to chimneys as listed in the B149.1-00 gas code and Standata.

SECTION FIVE: ..... PIPE TRADES PRACTICAL APPLICATIONS..... 50 HOURS

A. T-Drill, Brazing, Tube Bending and Grooved Pipe (060205a) ..... 12 Hours

Outcome: ***Install and service copper and iron pipe and fittings.***

1. State approved applications and identify the equipment required for mechanical T-pulled joints.
2. Describe the correct process for preparing a T-pulled mechanical joint. Safely T-pull to following prescribed procedures.
3. State the approved application and identify the name, grade, size and materials, including flux, used for brazed and silver soldered joints in piping systems. Safely braze project to correct dimensions following prescribed procedures.
4. Identify the equipment pertaining to brazing and silver soldering, select the required tip and balance a torch.
5. Identify by name, grade, size and material, the tools, tube and tubing used for bending purposes in the pipe trades. Safely bend tubing to correct dimensions following prescribed procedures.
6. Safely prepare grooved pipe, select fittings and interpret markings found on various grooved fittings and identify blueprint symbols used for grooved joints. Safely assemble to correct dimensions following prescribed procedures.
7. Describe the pressure and temperature ratings including colour coding of gaskets and correct installation procedure for groove pipe and fittings.

B. Rigging and Hoisting (060205b) ..... 8 Hours

Outcome: ***Apply Occupational Health and Safety regulations to rigging and hoisting.***

1. Recognize, name, and state characteristics, including safe work loads and detrimental application of different slings used for hoisting pipe, appliances, and components.
2. Identify and describe applications and positioning of cranes, hoists and cherry pickers.
3. Identify correct hand signals and use when directing a crane.
4. Recognize name and list safety requirements for various types of scaffolds and platforms used in the construction industry.

C. Fasteners and Drain Cleaning (060205c) ..... 6 Hours

Outcome: ***Install and service drainage and venting systems.***

1. List and describe non-power actuated fastening devices.
2. Describe the installation procedure for various fasteners and code requirements.
3. Identify the usage and limitations of various types of drain cleaning equipment and accessories for cleaning blockages.
4. Describe safe work procedures relating to liquid drain cleaners and fumes and gases present in the drainage system.

D. Valve Identification and Servicing ..... 3 Hours

Outcome: ***Identify and service common valves used in the pipe trades.***

1. Recognize, name, state major classification and application of valves used in the pipe trades.
2. State various characteristics and identify factors that influence valve selection.
3. De-assemble, identify component parts and safely re-assemble valves.
4. Check that valve is operating correctly.

E. Residential Rough-in With Double Plumbing ..... 6 Hours

Outcome: ***Rough-in DWV for a single family dwelling, to specific requirements and dimensions, serving the following fixtures: kitchen sink, water closet, lavatory, bath tub, laundry stand pipe and floor drain and double plumbing in the basement***

1. Select the required tools and materials for the project.
2. Layout, sketch and size with reference to current plumbing code and standards.
3. Measure, mark, cut and safely install DWV with correct grades.
4. Support piping to code requirements.
5. Test the project.

F. Hot Water Boilers and Trim ..... 3 Hours

Outcome: ***Identify various hot water heating boilers and associated trim.***

1. Identify residential and small commercial boilers.
2. Check installation requirements and testing procedures for boilers.
3. Review and solve common service problems associated with boilers.
4. Review and solve common service problems associated with systems.
5. Identify trim and check the function for the operation of a hydronic heating system.

G. Gas Line Installation ..... 6 Hours

Outcome: ***Install pipe and fittings to low pressure gas appliances.***

1. Pipe to three residential gas appliances.
2. Layout, size and sketch gas pipe installation with reference to correct codes and tables.
3. Compile materials list.
4. Measure, mark, cut, ream and thread gas pipe safely, to correct dimensions.
5. Install and hang gas line following code and general safety requirements.
6. Test installation to correct code requirements.

H. Tour ..... 6 Hours

Outcome: ***Tour commercial facility suitable for second period apprentices.***

1. Identify major plumbing equipment.
2. Identify the installed fixtures, accessories, equipment and controls. List and describe their function.
3. List and describe the requirements for safe installation of fixtures, accessories, equipment and controls.

SECTION SIX:.....PIPEFITTING AND WELDING..... 24 HOURS

A. Welding Safety, Tools and Symbols (060206a) ..... 6 Hours

Outcome: ***Identify fabrication processes for welded pipe and fittings.***

1. Identify safety practices pertaining to welding.
2. List and describe the hand tool required for welding.
3. List and describe the proper use and maintenance of grinders and discs.
4. Identify various welding symbols used in the pipe trades.

B. Welding and Cutting Theory (060206b) ..... 6 Hours

Outcome: ***Identify fabrication processes for welded pipe and fittings.***

1. Identify different types of metals using simple tests.
2. Describe the proper use of a cutting torch.
3. Describe the importance of proper tip selection and maintenance.
4. List and describe the types and usage of various filler rods and fluxes.

C. Bracket Project ..... 6 Hours

Outcome: ***Fabricate and construct a welded pipe bracket to specific dimensions.***

1. Select, mark and measure materials to required dimensions.
2. Demonstrate proper tip selection and maintenance.
3. Use cutting torch safely, following correct procedures.
4. Assemble bracket, choose correct filler rod and tack or weld pipe bracket to specific requirements.

D. Pipefitting Project ..... 6 Hours

Outcome: ***Fabricate and construct a steel piping spool piece to specific dimensions.***

1. Select by name, grade, symbols, size and the materials detailed on spool sheet.
2. Mark and measure materials to required dimensions.
3. Cut and prepare pipe-ends and fittings to required specifications.
4. Use hand and power tools safely, following correct procedures.
5. Assemble spool, and tack pipe to specific requirements.

SECTION SEVEN ..... MATH AND SCIENCE ..... 20 HOURS

A. Volumes, Capacities and 45° Offsets (060207a) ..... 6 Hours

Outcome: ***Implement mathematical calculations relevant to the trade.***

1. State formulas for calculating volumes and capacities of regular shaped solids, tanks and cylinders.
2. Calculate capacity of regular shaped tanks and cylinders using both metric and imperial values.
3. Define terminology applied to 45° offsets.
4. Calculate simple 45° offsets including fitting allowance.
5. Calculate 45° offsets around a corner.
6. Describe and apply the Pythagorean Theorem.

B. Pressure and Flow of Gases, Buoyancy and Water Properties (060207b) ..... 8 Hours

Outcome: ***Use standard science fundamentals relevant to the trade.***

1. List and describe the chemical properties of water and the effect of temperature in a hot water heating system.
2. State the three laws of buoyancy and describe the effect of buoyancy on regular shaped objects submersed in water.
3. List and describe the terminology pertaining to the flow of water in a plumbing system.
4. List and describe the operation of a venturi and the cause, effects and prevention of cavitation.
5. State formulas for solving simple head pressure calculations.
6. List and describe the principles of Boyle's Law on the behaviour of perfect gases.
7. List and describe the principles of Charles' Law on the behaviour of perfect gases.
8. Calculate simple problems using Boyle's and Charles' Law.

C. Electricity, Heat Loss, Levers and Mechanical Advantage (060207c) ..... 6 Hours

Outcome: ***Use standard science fundamentals, fundamentals of electricity and calculate heat loss relevant to the trade.***

1. List and describe basic principles of electricity including direct and alternating current flow, electrolysis and electromagnetism.
2. Sketch and describe simple electrical circuits, and the calculation of Ohm's Law.
3. Define terminology pertaining to the calculation of heat loss values.
4. Calculate a simple heat loss through a typical wall.
5. Define and describe pulleys, classifications of levers and mechanical advantage.
6. State the application of pulleys and levers including the demonstration of mechanical advantage.

SECTION EIGHT: ..... BLUEPRINT READING ..... 24 HOURS

A. Single Line Pipe Drawings (060208a) ..... 6 Hours

Outcome: ***Interpret isometric and orthographic drawings.***

1. Describe the process for drawing orthographic views of 90° offsets.
2. Describe the process for drawing orthographic views of 45° offsets.
3. Describe the process for drawing isometric single line piping arrangements following proper orientation from orthographic north to isometric north.
4. Describe the process for drawing ground works using orthographic techniques.
5. Describe the process for drawing DWV stacks and branches to specifications using isometric techniques.

B. Specifications and Blueprint Divisions (060208b) ..... 6 Hours

Outcome: ***Read a set of specifications or blueprints and locate the information you need to complete the mechanical portion of a construction project.***

1. Define the five common divisions of a residential blueprint.
2. Describe the purpose of blueprint divisions.
3. Identify and explain the Constructions Specification Institute (CSI) format.
4. Read and interpret simple architectural and mechanical specifications.

C. Blueprint Views and Elevations (060208c) ..... 6 Hours

Outcome: ***Be able to locate information that is important for the mechanical portion of a construction project and to locate elevations on a set of blueprints or calculate them from available information.***

1. Identify views and drawings of a building.
2. Interpret and explain views and drawings of a building.
3. Identify various elevations in both imperial and metric measurements.
4. Interpret various elevations found on a blueprint.

D. Interpretation of Blueprint Package (060208d) ..... 6 Hours

Outcome: ***Correctly read and interpret blueprints contained in the package.***

1. Identify schedules and specifications.
2. Interpret and explain views of a building.
3. Identify various elevations.
4. Identify plumbing fixtures and locations of fixtures.
5. Determine correct location of DWV and water distribution systems.
6. Analyze blueprints for possible installation conflicts.

THIRD PERIOD TECHNICAL TRAINING
PLUMBER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:.....PRIVATE SEWAGE DISPOSAL SYSTEMS..... ..... 18 HOURS

A. Introduction to Private Sewage Disposal Systems (060301a) .....4 Hours

Outcome: ***Apply rules necessary to complete a private sewage disposal system installation.***

1. List and describe regulations that apply to the design and installation of private sewage disposal systems.
2. List and describe health hazards and environmental contamination that may occur through improper private sewage disposal.
3. Identify hazards present when working with private sewage system components.
4. List and describe the steps for planning a private sewage disposal system.

B. Septic Tanks, Effluent Chambers and Holding Tanks (060301b) .....6 Hours

Outcome: ***Apply the rules necessary to complete a private sewage disposal system installation.***

1. Define a septic tank, holding tank and effluent chamber, describe construction materials and identify various parts within a septic tank.
2. Describe the operation of a septic tank.
3. State the minimum size of septic tanks and describe the correct sizing procedures.
4. State factors that determine the elevation of a septic tank with an effluent chamber.
5. Describe the maintenance requirements for septic chambers.
6. Describe the sizing of effluent chambers.

C. Approved Effluent and Sewage Treatment Components (060301c) .....8 Hours

Outcome: ***Install and service a private sewage disposal system.***

1. Describe approved methods for treatment and disposal of effluent and sewage.
2. Describe the tests required to size disposal component requirements.
3. Define and describe approved sub-surface fields.
4. Describe the design and construction requirements for sub-surface field.
5. Describe a mound.
6. Describe the design and construction requirements for a treatment mound.
7. State the requirements for open discharge disposal.
8. State the requirements for sewage and effluent lagoons.

SECTION TWO: .....PLUMBING THEORY ..... 66 HOURS

A. Residential Drainage Waste and Vents Including Sumps and Backwater Valves (060302a) ..6 Hours

Outcome: ***Install and service a private sewage disposal system.***

1. Describe approved methods for treatment and disposal of effluent and sewage.
2. Describe the tests required to size disposal component requirements.
3. Define and describe approved sub-surface fields.
4. Describe the design and construction requirements for sub-surface field.
5. Describe a mound.
6. Describe the design and construction requirements for a treatment mound.
7. State the requirements for open discharge disposal.
8. State the requirements for sewage and effluent lagoons.

B. Floor Drains, Gang Showers, Washing Machines (060302b) and Circular Rainwater Leaders.....8 Hours

Outcome: ***Install floor drains gang showers, washing machines and circular rainwater leaders.***

1. Define floor drains and identify and describe correct installation practices and code requirements for various applications.
2. Illustrate multiple floor drain installations and describe code requirements for sizing.
3. Define and describe correct installation procedures for gang showers including code requirements.
4. Define washing machines and identify and describe correct installation practices and code requirements for various applications.
5. Define rainwater leader and terms pertaining to area storm water and describe installation methods for rainwater leaders, area storm drains and correctly size piping following code requirements.

C. Island Vents, Vent Stacks and Relief Vents Between DWV Stacks (060302c) .....8 Hours

Outcome: ***Install island vents, vent stacks and relief vents and apply the rules pertaining to the installation of venting systems for various conditions of use.***

1. Define island vents and describe the proper installation technique.
2. Describe correct sizing requirements for island vents including cleanout locations.
3. Define and describe a vent stack and the principle of operation.
4. Identify code requirements and correct sizing procedure for vent stacks.
5. Define and size vents required between DWV stacks in a high rise building including offsets as required by code.

D. Commercial Wet Vent Installation (060302d) ..... 6 Hours

Outcome: ***Install groups of more than eight fixtures, using the appropriate venting methods, when more than six fixture units pass by the lowest point of connection.***

1. Define commercial wet venting.
2. Illustrate various combinations of wet vented plumbing groups including continuous and relief vents.
3. Identify additional vents required for commercial wet vented groups of fixtures.
4. List and describe correct installation techniques for horizontal and vertical wet vent applications.
5. Identify code requirements for continuous and relief vents.
6. Size various piping configurations using appropriate tables.

E. Potable Water Distribution System (060302e) ..... 10 Hours

Outcome: ***Install and service water distribution systems in accordance with the National Plumbing Code, plumbing bulletins and/or manufacturer specifications. Apply the rules pertaining to the installation of potable water systems for various conditions of use.***

1. List and describe the two basic water distribution systems.
2. List and describe the operation and application of a municipal water distribution system.
3. List and describe the conditions in which a booster pump is required.
4. List and describe the importance and placements of air vents, vacuum breakers, air chambers and shock absorbers.
5. State how fixture unit rating applies to the sizing of potable water lines and list the fixture unit rating for common plumbing fixtures.
6. Size a commercial potable water distribution system for a multi-storey high rise including: flush valves, recirculating line and booster pump.
7. Describe proper water meter installation requirements for water meters larger and smaller than one inch.
8. List and describe proper locations for shutoff valves and installation procedures for commercial lawn service faucets.
9. Describe the methods of controlling condensation on potable water distribution lines.
10. Interpret code and requirements for installation and sizing of potable water lines including flushing and testing.

F. Water Heating Appliances and Hot Water Recirculation (060302f) ..... 6 Hours

Outcome: ***Install and service hot water heaters and hot water recirculation piping systems.***

1. Identify types of water heaters available for residential and commercial applications.
2. List and describe sizing, operation and application of water heaters available for residential and commercial applications.
3. List and describe installation techniques for residential and commercial water heaters including parallel and series connections.
4. List and interpret code regulations pertaining to the installation of hot water heaters.
5. List applications and common terminology associated hot water recirculation installations.
6. List and describe installation techniques associated with hot water recirculation installations.

G. Pressure Reducing Valves and Booster Pumps (060302g) ..... 4 Hours

Outcome: ***Install and service pressure reducing valves and booster pumps.***

1. Identify and describe types and operation of pressure reducing valves and booster pumps.
2. List and describe installation requirements and code references for pressure reducing valves.
3. Identify and describe types and operation of booster pumps.
4. List and describe installation requirements, trouble shooting procedures and code references for booster pump installations.

H. Faucet and Flushometers (060302h) ..... 8 Hours

Outcome: ***Install and service faucets and flush valves.***

1. List and identify types of faucets.
2. List and describe manufacturer's installation requirements for various faucets.
3. Identify common faucet components for various faucets.
4. State service problems associated with various facets and describe procedures for correction of service problems.
5. List tools and materials required for installation and servicing of various faucets.
6. List and describe code regulations and safety requirements for installing and repairing faucets.
7. List and describe and identify the types of flush valves approved for the installation on urinals and water closets.
8. List and describe parts operation and adjustment of various flush valves.

I. Plumbing Fixtures(060302i) ..... 10 Hours

Outcome: ***Install and service plumbing trim, fixtures and appliances.***

1. List and describe common terminology associated with the following fixtures: jet tubs, bar sinks, bidets, drinking fountains, gang showers, urinals, laboratory sinks and three compartment sinks.
2. Describe the operation of each fixture.
3. List and describe the materials from which the fixtures listed above may be manufactured.
4. List and describe common fixture trim required for the listed fixtures.
5. List the water and drain sizing requirements for each of the listed fixtures.
6. List and describe proper installation technique for each of the fixtures.
7. Describe proper water meter installation requirements for water meters larger and smaller than one inch.
8. Identify common service problems for each fixture.
9. Identify code and requirements for each fixture.

SECTION THREE: ..... HYDRONIC RADIANT HEATING..... 22 HOURS

A. Hydronic Radiant Heating and Heat Loss Calculations (060303a).....6 Hours

Outcome: ***Install and service residential radiant floor hot water heating systems.***

1. List definitions pertaining to hydronic radiant heating systems.
2. Describe the differences between hydronic radiant heating and other heating systems.
3. List and describe the advantages and disadvantages of a hydronic radiant heating system, including problems with poorly designed systems.
4. List and describe applications for hydronic radiant heating systems and materials used for installations.
5. State and describe the importance of proper system water temperatures.
6. Describe the process for determining heat loss for one room of a single-family dwelling.
7. Calculate the heat loss for one room of a single-family dwelling.

B. Introduction to Hydronic Radiant Heating Design (060303b) .....12 Hours

Outcome: ***Install and service residential radiant floor hot water heating systems.***

1. Describe process for determining the number of zones and size, spacing and length of piping required.
2. List and compare various piping layouts and state their application.
3. List and describe correct installation practice of circuits and supplemental heat source when required.
4. Describe methods of zoning and balancing systems including header sizing.
5. Describe the correct procedure for pump selection.
6. Describe types of boilers, controls and water requirements for radiant floor heating system.
7. List code requirements for radiant floor hydronic heating systems.

C. Boiler Start-Up and Servicing (060303c) .....4 Hours

Outcome: ***Install and service residential radiant floor hot water heating systems.***

1. Describe manufacturers' start-up procedure.
2. Describe service procedures for boilers.
3. Describe service procedures for controls.
4. Describe basic maintenance procedures for radiant floor heating system.

SECTION FOUR: .....GASFITTING THEORY AND LAB ..... 64 HOURS

A. Sizing Chimneys and Flues (060304a) .....8 Hours

Outcome: ***Apply rules pertaining to the installation of venting systems for gas-fired appliances under various conditions of use.***

1. List and describe regulations that relate to minimum and maximum vent sizing requirements that overrule vent sizes determined from the vent sizing table.
2. Calculate natural draft vent sizes for a single appliance using both tables and rule of thumb method.
3. Calculate vent connector sizes for multiple appliances (natural draft) using both sizing tables and rule of thumb methods.
4. Calculate vent sizes for multiple appliances (natural draft) using both sizing tables and rule of thumb methods.
5. List and describe regulations that relate to the minimum and maximum chimney sizing regulations that overrule chimney sizes determined from the chimney sizing tables.
6. Calculate chimney sizes for a single appliance using both sizing tables and rule of thumb methods.
7. Calculate chimney sizes for multiple appliances using both sizing tables and rule of thumb methods.
8. Describe the procedure for converting areas of round chimney to rectangular chimney and rectangular chimney to round chimney using sizing tables in the B149 gas code.

B. Air Supply (060304b) .....4 Hours

Outcome: ***Apply rules pertaining to the installation of air supply for appliances and calculate the size of air supply ducts, grilles and louvers needed for different applications.***

1. State the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to the air supply required to provide air for combustion, ventilation and flue gas dilution.
2. Explain the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins relating to air supply ducts and grille sizes required.
3. State and calculate the required duct size and free area ratios of the grilles for various applications.
4. State the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to air supply by mechanical means.

C. Domestic Gas Fired Appliances (060304c) ..... 8 Hours

Outcome: ***Apply rules pertaining to the installation of various domestic gas-fired appliances in regards to installer responsibilities, suitability, location, clearances to combustibles materials and accessibility.***

1. List and explain regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to domestic gas-fired appliances regarding installer responsibilities.
2. List and explain the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to conversions of domestic gas-fired appliances.
3. Describe methods of reducing clearances to combustible materials to combustible materials for domestic gas-fired appliances.
4. List and explain regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to domestic gas-fired appliances including (but not limited to): a) boilers, b) clothes dryers, c) counter appliances, d) direct vent and decorative appliances, e) ranges, f) furnace/space heating, g) domestic water heating.

D. Basic Electricity for Gas Appliances and Controls (060304d) ..... 6 Hours

Outcome: ***Select and utilize appropriate meter and test equipment to measure electrical values to service gas-fired appliances.***

1. List, define and describe common electrical terminology and the application of Ohm's law as used with AC and DC circuits for gas appliances and controls.
2. Identify electrical testing devices.
3. Describe proper settings for electrical testing equipment.
4. Describe proper methods for measuring amperes, volts and ohms in typical gas appliance circuits.
5. Describe proper procedures for determining continuity in wires, coils, circuits and other electrical components found on gas appliances.
6. Describe the use of test lights for determining continuity in wires, coils, circuits and other electrical components found on gas appliances.

E. Electrical Circuits for Domestic Gas Appliances and Gas Controls (060304e) ..... 6 Hours

Outcome: ***Interpret electrical and electronic wiring diagrams and calculate volts, ohms and amperes.***

1. List and describe common types of electrical circuits found on gas appliances and controls: series, parallel and a combination of series and parallel circuits.
2. Apply Ohm's Law involving simple circuits for gas controls and appliances.
3. Identify various symbols on electrical diagrams with components on domestic gas appliances and controls.
4. Match symbols on electrical diagrams with components on domestic gas appliances and controls.
5. Read and interpret wiring symbols.
6. Interpret various wiring diagrams: schematics, pictorial, and line (ladder) diagrams.

F. Gas and Electrical Controls Lab (060304f) ..... 8 Hours

Outcome: ***Determine the operational principles of controls, test and service controls, and properly set up and adjust various controls on gas-fired appliances.***

1. Identify and describe the operating principles of thermally operated controls.
2. List and describe adjustment techniques and routine maintenance requirements for thermally operated controls.
3. Describe proper technique for leak testing thermally operated gas valves.
4. Identify and describe the operating principles and procedure for determining voltage, amperage and wattage of electrical controls.
5. List and describe diagnostic techniques and routine maintenance requirements for electrical controls.

G. Propane Cylinders and Vaporization (060304g) ..... 6 Hours

Outcome: ***Apply rules pertaining to the installation and service of bulk propane cylinders, service valves and accessories for various conditions of use.***

1. Interpret regulations in the B149.2 Propane Storage and Handling Code and the Plumbing and Gas Safety Services Bulletins pertaining to customer propane storage cylinders on the customer's property.
2. List and describe criteria for sizing cylinders for customer's application.
3. List and describe installation procedures for cylinders including clearances, maintenance and code requirements.
4. List and describe safety relief valves used on propane storage cylinders including pressure settings, discharge piping locations and code requirements.
5. List and describe valves and accessories, including maintenance, on customer storage cylinders for vapour withdrawal.
6. List and describe valves and accessories, including maintenance, on customer storage cylinders for liquid withdrawal.

H. Domestic Appliance Installation and Servicing Lab (Including Mid and High Efficiency)..... 12 Hours

Outcome: ***Check the application of gas codes, manufacturer's requirements, rating plate data, pertaining to the installation of various domestic gas-fired mid and high efficiency appliances. Check for installer responsibilities, location, clearances, gas-line, vent and combustion air requirements.***

1. Check for correct installation requirements with reference to regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to gas-fired appliances regarding installer responsibilities.
2. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins regarding to venting of domestic gas-fired appliances.
3. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to combustion air requirements of domestic gas-fired appliances.
4. Assess correct installation requirements in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to domestic gas-fired appliances including (but not limited to): a) boilers, b) clothes dryers, c) counter appliances, d) direct vent and decorative appliances, e) ranges, f) furnace/space heating, g) domestic water heating.
5. Safely test and set appliances operating and safety controls to correct requirements.
6. Check that appliance is operating correctly and according to codes and manufacturer's requirements.

I. Appliance Gas Controls and Wiring Lab ..... 12 Hours

Outcome: ***Wire electrical and electronic wiring diagrams to required controls.***

1. Wire common types of electrical circuits found on gas appliances and controls: series, parallel and a combination of series and parallel circuits.
2. Apply Ohm's Law involving simple circuits for gas controls and appliances.
3. Identify various symbols on electrical diagrams with components on domestic gas appliances and controls.
4. Match symbols on electrical diagrams with components on domestic gas appliances and controls.
5. Interpret and apply various wiring diagrams: schematics, pictorial, and line (ladder) diagrams.
6. Safely test and set appliances operating and safety controls to correct requirements.
7. Check that appliance is operating correctly and according to codes and manufacturer's requirements.

SECTION FIVE: ..... PRACTICAL APPLICATIONS ..... 30 HOURS

A. Builders Level (060305a) ..... 4 Hours

Outcome: ***Locate elevations, calculate grades and apply rules pertaining to the installation of piping systems for various conditions of use.***

1. Identify various types of builder's levels and list and describe terminology associated with the use of builder's levels.
2. Describe the use of builder's levels to determine prescribed elevations.
3. Correctly demonstrate the safe use of builder's levels to located prescribed elevations.
4. Complete a survey record sheet.

B. Commercial Rough-in With Wet Vented Fixtures With Continuous and Relief Vents ..... 4 Hours

Outcome: ***Rough-in DWV for commercial installation to specific requirements and dimensions, to include at least one wet vented group of eight wet vented fixtures or more connecting to a building drain carrying more than six fixture units.***

1. Select the required tools and materials for the project.
2. Layout, sketch and size with reference to current plumbing code and standards.
3. Safely measure, mark, cut and assemble DWV with correct grades.
4. Support piping to code requirements.
5. Test the project.

C. Residential Rough-In ..... 4 Hours

Outcome: ***Rough-in DWV for a single family dwelling, to specific requirements and dimensions, and to include the additional following fixtures: connections for jet tub, double plumbing, bar sink, back water protection and weeping tile protection.***

1. Select the required tools and materials for the project.
2. Layout, sketch and size with reference to current plumbing code and standards.
3. Safely measure, mark, cut and assemble DWV with correct grades.
4. Support piping to code requirements.
5. Test the project.

D. Faucet Service ..... 4 Hours

Outcome: ***Troubleshoot and correctly service various plumbing faucets.***

1. Identify and name the various types of plumbing faucets.
2. Identify common service problems associated with faucets.
3. Select proper tools and safely disassemble faucets and select replacement parts using manufacturers' catalogues and service manuals.
4. Replace necessary parts and re-assemble leaving faucet in a safe operating condition.

E. Hot Tapping (060305a) ..... 2 Hours

Outcome: ***Attend a demonstration of the correct application and performance of hot tapping to required standards and specifications.***

1. State the basic safety procedure for the use of a hot trap including proper valve selection and placement.
2. Identify correct assembly of the hot tap machine including proper valve selection and placement.
3. State problems that can arise if proper procedures are not followed.
4. List procedures for leaving installation in safe operating condition.

F. Flush Valve Service Shop ..... 4 Hours

Outcome: ***Troubleshoot and correctly service various flush valves.***

1. Identify and name the various types of flush valves.
2. Identify common service problems associated with flush valves.
3. Select proper tools and safely disassemble flush valves and select replacement parts using manufacturers' catalogues and service manuals.
4. Replace necessary parts and re-assemble leaving flush valves in a safe operating condition.

G. Parallel Piping Offsets ..... 4 Hours

Outcome: ***Install parallel piping offsets to specific requirements and dimensions.***

1. Select the required tools and materials for the project.
2. Calculate rise and travel of offsets with allowance for fittings.
3. Measure, mark, cut and prepare pipe and fittings as necessary.
4. Safely assemble parallel offsets to correct dimensions and prescribed requirements.

H. Tour ..... 4 Hours

Outcome: ***Tour mechanical facility suitable for third period apprentices.***

1. Identify major heat generating equipment.
2. Identify the installed accessories and controls and list and describe their function.
3. List and describe the requirements for safe installation generating equipment, accessories and controls.

SECTION SIX: ..... TRADE MATHEMATICS AND SCIENCE ..... 18 HOURS

A. Volumes, Capacities Surface Areas (060306a) ..... 4 Hours

Outcome: ***Implement mathematical calculations relevant to the trade.***

1. State formula and calculate the volumes in imperial and capacities of regular shaped tanks, and flat end cylinders and flat end cylinders in imperial and metric units.
2. State the formula for calculating surface area and the total force on a surface area in metric and imperial units.
3. State the formula and calculate storm water capacities in metric and imperial units.
4. State the safe trenching requirements and calculate volumes of soil removed from various trench applications in metric and imperial units.

B. Square Roots, Piping Offsets and Fitting Allowance (060306b) ..... 6 Hours

Outcome: ***Use a calculator to calculate square roots. Calculate travel lengths for offsets, both equal and unequal spread, fitting allowances, cut lengths of welded and threaded piping, from single-line drawings.***

1. Calculate square root using an appropriate calculator.
2. State the formula for calculating 22 ½ and 45 degree offsets.
3. Calculate offset travel using both imperial and SI units for unequal spread offsets.
4. Calculate offset travel using both imperial and SI units for equal spread offsets.
5. Calculate fitting allowance in both imperial and SI units.
6. Calculate cut lengths of pipe and tube in both imperial and SI units.

C. Fixture Spacing (060306c) ..... 4 Hours

Outcome: ***Use manufacturers hand book to properly space bathroom fixtures in residential and commercial applications, for both normal and barrier-free installations.***

1. With the aid of a manufacturers hand book state the minimum clearances for fixtures.
2. Design a typical bathroom stating fixture spacing requirements for both residential and commercial applications in metric and imperial measurements.
3. State the fixture spacing requirements in bathrooms that incorporate barrier-free design.

D. Grades and Elevations (060306d) ..... 4 Hours

Outcome: ***Locate elevations and calculate grades.***

1. Calculate grades in both imperial and imperial units using appropriate formulas.
2. Calculate hanger spacing using applicable code spacing requirements.
3. Calculate vertical distances in both imperial and metric values using geodetic, abbreviated geodetic and architectural elevations.

SECTION SEVEN: ..... BLUEPRINT READING SKETCHING AND DRAWING ..... 24 HOURS

A. Residential DWV Sketching (060307a) ..... 6 Hours

Outcome: ***Sketch and draw residential plumbing installations using both SI and imperial measurements.***

1. Sketch plumbing ground work to specifications using orthographic techniques.
2. Sketch plumbing ground work to specifications using isometric techniques.
3. Draw plumbing DWV stacks to specifications using isometric techniques.
4. Use manufacturers rough-in books for location of DWV connections.
5. Compile a material list required for the installation.
6. Using a material pricing manual, compile a price for a DWV system.

B. Commercial DWV Sketching and Drawing (060307b) ..... 6 Hours

Outcome: ***Sketch and draw residential and commercial plumbing.***

1. Sketch commercial ground work to specifications using orthographic techniques.
2. Sketch commercial ground work to specifications using isometric techniques.
3. Draw commercial plumbing DWV stacks and branches to specifications using isometric techniques.
4. Use manufacturers rough-in books for location of DWV connections.
5. Compile a material list required for the installation.

C. Applied Blueprint Reading (060307c) ..... 12 Hours

Outcome: ***Correctly read and interpret residential and commercial blueprints.***

1. Identify divisions of blueprints.
2. Interpret and explain views of a building.
3. Identify various elevations and schedules.
4. Read and interpret site, floor and plot plans.
5. Read and interpret specifications.
6. Identify plumbing fixtures and locations of fixtures.
7. Determine correct location of DWV and water distribution systems.
8. Analyze blueprints for possible installation conflicts.

FOURTH PERIOD TECHNICAL TRAINING
PLUMBER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... PRIVATE WATER SUPPLY AND WATER TREATMENT..... 34 HOURS

A. Introduction to Private Water Supply Systems (060401a).....4 Hours

Outcome: ***Interpret the sizing requirements for a farm and residential private water supply system.***

1. List and define the terminology pertaining to water wells.
2. Define terminology pertaining to a private water supp and list daily requirements for different applications.
3. List and describe sources for private water supply and common sources of water supply contamination.
4. Describe the types of wells associated with private water supplies.

B. Pumps for Private Water Supply Systems (060401b) .....4 Hours

Outcome: ***Interpret the sizing requirements for various pumps installed on a private water supply system.***

1. List and describe basic scientific principles pertaining to the operation of a water supply pump.
2. Describe types, classifications and application of various pumps used on private water supply systems.
3. Describe procedure to correctly size a water supply system for various applications.
4. Describe maintenance problems encountered when using pumps and common causes and solutions for these problems.

C. Private Water Supply Pressure System Components (060401c).....4 Hours

Outcome: ***Fashion a private water distribution system that will meet the requirements set out for it and designed to allow ease of maintenance and upkeep.***

1. List and describe components of a private water system.
2. Describe the relationship between head, pressure, friction loss and flow rates.
3. List and describe the basic types of pressure tanks used on private water supply systems.
4. Describe correct installation procedure for private water system components including sizing and electrical requirements.
5. Describe maintenance problems associated with private water systems components including common causes and solutions for these problems.

D. Private Water Supply Pressure System Sizing (060401d) ..... 4 Hours

Outcome: ***Interpret the sizing requirements for a farm and residential private water supply system.***

1. Describe factors to consider when designing and sizing a private water supply system.
2. Describe how to correctly size a pump and pressure system to deliver a required volume of water.
3. Describe the sizing procedure for a private water system for a farm application and a residential application.
4. List the tools and equipment required and describe the code requirements to complete a proper installation.

E. Introduction to Water Treatment (060401e) ..... 4 Hours

Outcome: ***Lay out and install a complete residential water treatment system.***

1. List and describe terminology pertaining to water, the water cycle and water treatment.
2. List and describe the classes of water supply and sources of water supply.
3. Define the various types of hardness found in water, the effects of hardness on a water system and how to measure hardness.
4. List and describe impurities found in water from various sources.

F. Impurities in Water (060401f) ..... 6 Hours

Outcome: ***Lay out and install a complete residential water treatment system.***

1. List impurities found in water.
2. Describe the tests available to measure contaminants and identify when water treatment is required.
3. List and describe water-associated problems caused by hardness.
4. List and describe water-associated problems caused by iron.
5. List and describe water-associated problems caused by other chemical impurities.
6. List and describe water-associated problems caused by biological impurities.

G. Methods of Treatment and Equipment Installation (060401g) ..... 8 Hours

Outcome: ***Interpret the sizing requirements for farm and residential private water supply systems.***

1. List and describe methods of treating contaminants in the water supply.
2. Identify the upper limits of each method of water treatment.
3. Identify and state the primary components of modern water treatment equipment.
4. List and describe the operation and regeneration cycles of modern water treatment equipment.
5. State the method and calculate the capacity of various types of water treatment equipment.
6. Describe correct installation procedures for various types of water treatment.
7. List and describe instructions for operation and maintenance for the customer.
8. List common maintenance problems and describe correct remedial procedures.

SECTION TWO: ..... SPECIAL APPLICATIONS ..... 40 HOURS

A. Cross Connection Control Awareness (060402a) ..... 10 Hours

Outcome: ***Install and service cross-connection control devices.***

1. Define the term cross connection control and state the requirements for tester certification.
2. Briefly discuss the history of cross connection control in Canada and the program status in Alberta.
3. List and describe definitions that pertain to cross connection control.
4. Describe the classification of hazards and list typical health issues that may result from cross connection.
5. State the liabilities and responsibilities at all levels of a cross connection control program.
6. List case histories of cross connections in Canada resulting in inadequate protection.
7. State regulations pertaining to cross-connection control.
8. List and identify the major categories of cross connection control devices and describe their operation.
9. List and describe correct installation procedures for each category of cross-connection devices and list examples of preventing backflow in a potable water supply.
10. Describe the testing procedure for a pressure vacuum breaker.

B. Specialty Water Distribution, Control Valves and Equipment (0060402b) ..... 8 Hours

Outcome: ***Understand the application and method of operation of urinal flush tanks, trap primers, different styles of temperature controlled valves and the proper method of connection for a sterilizer.***

1. List and identify the various automatic urinal flush tanks and components.
2. Describe proper installation of an automatic urinal flush tank including regulation of flush, waterline sizing requirements and troubleshooting.
3. List and describe various types of trap seal primers and their operations.
4. Describe the correct sizing installation and troubleshooting for various trap seal primers.
5. List and identify various types of specialty trim and equipment used in the plumbing trade pertaining to:
   a) blended water controls
   b) pressure balancing valves
   c) tempered water controls
   d) sterilization equipment
6. State the application for each type of valve listed in objective five:
   a) blended water controls
   b) pressure balancing valves
   c) tempered water controls
   d) sterilization equipment
7. Describe the installation procedure for each type of valve listed in objective five:
   a) blended water controls
   b) pressure balancing valves
   c) tempered water controls
   d) sterilization equipment

8. Describe troubleshooting techniques for valves listed in objective five:
   a) blended water controls
   b) pressure balancing valves
   c) tempered water controls
   d) sterilization equipment

C. Introduction to Residential Fire Sprinkler Systems (060402c) ..... 4 Hours

Outcome: ***Install and service piping and equipment to a residential sprinkler system using applicable regulations.***

1. Identify codes that pertain to the installation of residential sprinkler systems and list advantages and disadvantages of residential sprinkler systems.
2. Describe proper design and installation of residential sprinkler systems including:
   a) piping materials
   b) sprinkler and water requirements
3. Identify approved alarm requirements and describe how each alarm operates.
4. List and describe testing and maintenance requirements for residential sprinkler systems.

D. Wet Standpipe and Dry Standpipe Fire Lines (060402d) ..... 4 Hours

Outcome: ***Apply rules necessary to layout and install the piping and equipment for a wet and dry standpipe fire line system.***

1. Define common terminology associated with wet standpipe and dry standpipe systems and compare the differences between standpipe systems and automatic sprinkler systems.
2. List the types of building in which wet standpipe and dry standpipe systems are installed including the advantages and disadvantages or each systems.
3. Describe the requirements and layout of a typical wet standpipe system including:
   a) water connection
   b) Siamese connections
   c) frost protection for Siamese connections
4. List and explain the types of fire hose cabinets, locations, accessibility and control valves for a typical fire hose cabinet installation.

E. Swimming Pools and Spas (060402e) ..... 4 Hours

Outcome: ***Apply the rules necessary to install piping and equipment to swimming pools and spas.***

1. Identify and describe terminology that pertains to swimming pools and spas, chemicals used for treatment of swimming pool and spa water and MSDS requirements.
2. List, identify and state the function of swimming pool and spa equipment and components.
3. Identify piping arrangements used to circulate pool water through related pool and spa equipment.
4. List and describe regulations pertaining to the installation and maintenance of swimming pools and spas.

F. Compressed Air Systems (060402f) ..... 4 Hours

Outcome: ***Install piping and equipment to a compressed air system.***

1. Define compressed air and state the applications for compressed air systems.
2. Identify and describe operation of system components.
3. Identify and state how impurities and environment effects the operation of compressed air systems.
4. List and describe piping systems and correct installation procedures for compressed air systems.

G. Medical Gas Piping (060402g) ..... 3 Hours

Outcome: ***Install and service medical gas piping systems.***

1. Define medical gas piping and state the application for medical gas piping.
2. List the types of materials used to convey medical gas.
3. List and describe correct installation procedures for medical gas piping systems and equipment.

H. Lawn Irrigation (060402h) ..... 3 Hours

Outcome: ***Install and service a residential lawn irrigation system.***

1. Define various types of irrigation systems including blueprint and piping symbols.
2. Describe layout and installation materials including trenching, piping, sprinkler heads and controls.
3. Interpret plumbing code requirements and manufacturer's specifications regarding appropriate cross-section control devices.

SECTION THREE: ..... DRAIN WASTE AND VENTING ..... 42 HOURS

A. Interceptors and Indirect Wastes (060403a) ..... 8 Hours

Outcome: ***Install and service various types of interceptors and plumbing for indirect wastes.***

1. Define terminology associated with interceptors and describe various types of interceptors found in the plumbing trade.
2. Describe the function and application of various types of interceptors.
3. List and describe the operation of various types of interceptors.
4. State the differences between various interceptors.
5. Describe installation procedures for various types of interceptors.
6. Describe proper grease and sludge disposal and health associated risks when working with various interceptors.
7. List and describe terminology used to define wastes and identify applications.
8. List and describe proper installation and maintenance procedures for various applications of indirect wastes.
9. Interpret code requirements for indirect wastes.

B. Sewage Sumps, Receiving Tanks and Dumping Stations (060403b)..... 6 Hours

Outcome: ***Install and service plumbing to trailer parks and dumping stations.***

1. Define and describe the types and functions of sewage holding or receiving tanks.
2. Describe installation, operation and maintenance requirements for sewage holding or receiving tanks.
3. Define mobile home park, recreational vehicle and dumping station and list material approved for use with these applications.
4. List and describe proper installation procedures required for plumbing installations in mobile home parks and sewage dumping stations.
5. List and describe maintenance requirements and code requirements for mobile home park and dumping station applications.

C. DWV, Water Distribution and Fixtures for Residential Installation (060403c)..... 6 Hours

Outcome: ***Size and Install DWV and domestic water systems in a residence. Understand the type s of piping materials and fixtures used in a residence and how they should be installed and tested.***

1. Layout and sketch, isometric style, various DWV systems for residential applications.
2. List and describe proper installation procedures for above and below ground applications.
3. List and describe location for expansion control and back water valves.
4. Size various DWV and water distribution systems in residential applications.
5. Interpret code requirements relating to DWV and water distribution, installation and testing.
6. List materials required for a residential application including fixtures, trim DWV pipe and fitting and water distribution piping and fittings.

D. Specialty Plumbing Fixtures (060403d)..... 12 Hours

Outcome: ***Install and service fixtures for industrial, institutional or hospital installations.***

1. Identify and describe fixtures found in industrial, institutional and hospital applications.
2. Define common terminology associated with barrier-free applications.
3. List and describe materials that industrial, institutional and hospital fixtures may be manufactured from, and describe precautions when handling and installing these fixtures.
4. List and describe fixture trim required for industrial, institutional and hospital fixtures.
5. List and describe various means of water on/off control on industrial, institutional and hospital fixtures.
6. State fixture unit ratings, water supply drainage and venting requirements for industrial, institutional and hospital fixtures.
7. List and describe proper installation procedures for industrial, institutional and hospital code requirements.
8. List and describe tools and materials required for installation of industrial institutional and hospital fixtures.
9. Identify carriers, hardware and state their function.
10. List materials and tools required to install a carrier.

E. Commercial Equipment Installation (060403e) ..... 10 Hours

Outcome: ***Install and service fixtures for commercial installations.***

1. Identify and describe fixtures found in commercial applications.
2. Layout, isometric style, a commercial DWV system.
3. List and describe correct material requirements for DWV, water distribution, fixtures and trim.
4. List and describe correct installation procedure for DWV, water distribution, fixtures and trim.
5. List and describe appropriate cross connection control devices for various commercial applications.
6. Size a commercial DWV system.
7. Describe procedure for disposal of wastes over 75°C, (170°F).
8. Interpret plumbing code regulations for the installation of commercial fixtures.

SECTION FOUR: ..... PRACTICAL APPLICATIONS ..... 28 HOURS

A. Specialty Control Valve Service Shop ..... 4 Hours

Outcome: ***Identify, troubleshoot and correctly service specialty control valves.***

1. Identify and name the various types of specially control valves: bended water, pressure balancing, tempered water, thermostatic mixing and other applicable specially control valves.
2. List and identify various on/off mechanisms associated with specialty control valves.
3. Identify common service problems associated with control valves.
4. Select proper tools and safely disassemble valves and select replacement parts using manufacturer's catalogues and service manuals.
5. Replace necessary parts and re-assemble leaving flush valves in a safe operating condition.

B. Water Treatment Testing and Installation ..... 4 Hours

Outcome: ***List and identify installation procedures for water treatment equipment and test various water samples using water analyses test kits.***

1. Correctly identify component parts of several water analysis testing kits and completed tests on various water samples.
2. Following manufacturer's instructions determine the following: pH level, iron content and hardness content and complete a water analysis chart and interpret results.
3. Demonstrate correct use of the pH scale. Describe the effects of hardness and the ranges of water hardness.
4. Differentiate between: ferric iron, ferrous iron and iron bacteria and state maximum allowable limits of each for each in potable water.
5. Identify different types of water treatment equipment and list and describe their function, regeneration cycle and maintenance requirements.
6. Layout, sketch and size with reference to the plumbing code and manufacturer's specifications the installations of equipment to treat the following water conditions: moderate iron, bacteria, taste and odour and moderate hardness.
7. Install water treatment equipment in correct sequence in the system according to applicable codes, regulations and manufacturer's specifications. Correctly pipe drainage from water treatment equipment.

C. Water Closet Carriers Installing and Venting ..... 4 Hours

Outcome: ***Install and correctly vent a battery of water closet carriers.***

1. Identify water closets that require carriers.
2. Identify carrier hardware components and state their function.
3. Select tools and materials required to install carriers and venting systems.
4. Using manufacturers' rough-in books install carriers for wall-hung water closets for both general and handicapped use.
5. Correctly install DWV to a series of water closet carriers with regard to correct installation using manufacturer's information and the plumbing code.
6. Demonstrate how a number of carriers on the same elevation can be discharged into a single graded horizontal soil pipe.

D. Pump and Pressure Systems Installation and Service ..... 4 Hours

Outcome: ***Select and install pump and pressure system equipment.***

1. List and compare various pumps used for private water supply and describe the basic operating principles of each pump.
2. Correctly size pumps and pipe connections and apply correct pre-installation tests for different pumps.
3. Follow correct installation procedures with reference to applicable codes and manufacturer's specifications.
4. Read and interpret electrical wiring diagrams for pumps and controls.
5. Select correct tools and equipment and correctly install pumps for private water systems.
6. Describe basic operating principles various component parts of a pressure system.
7. List and describe accessories installed with the tanks and correctly size pressure and diaphragm tanks.
8. List and describe pre-installation tests for pressure and diaphragm and install tanks and accessories.
9. Identify and correct common service problems encountered with pressure systems.
10. List and describe test procedures for various operational problems identified.

E. Commercial Rough-In Groups of Wet-Vented Fixtures ..... 4 Hours

Outcome: ***Rough-in DWV for commercial installation to specific requirements and dimensions, to include several groups of more than eight wet vented fixtures connecting to a building drain carrying more than 15 fixture units.***

1. Select the required tools and materials for the project. Ground work rough-in must include a grease interceptor and back-water protection.
2. Compile a materials list and layout, sketch and size with reference to current plumbing code and standards.
3. Safely measure, mark, cut and rough-in DWV with regard to correct interpretation of codes and correct installation techniques.
4. Support piping to code and state requirements for testing.

FOURTH PERIOD

F. Rolling Offset ..... 4 Hours

Outcome: ***Install rolling piping offsets to specific requirements and dimensions.***

1. Select the required tools and materials required for completing the specified project the project.
2. Calculate rise, travel and role of offsets with allowance for fittings.
3. Measure, mark, cut and prepare pipe and fittings as necessary.
4. Safely assemble parallel offsets to correct dimensions and prescribed requirements.

G. Tour ..... 4 Hours

Outcome: ***Tour mechanical facility suitable for fourth period apprentices.***

1. Identify major operating processes and equipment.
2. Identify the installed accessories and controls and list and describe their function.
3. List and describe the requirements for safe installation of processes and applicable generating equipment, accessories and controls.

SECTION FIVE: .....GASFITTING THEORY AND LAB ..... 64 HOURS

A. Low-Pressure Gas Line Layout Including Venting and Air Supply (060405a) ..... 10 Hours

Outcome: ***Select, size and install gas line venting and air supply requirements for a large residential application.***

1. Describe the process for the layout of the low pressure gas line for both natural and propane gas installations including the following appliances:
   a) 2 – 120 000 Btu furnaces
   b) 2 – 50 000 Btu water heaters
   c) 1 – 32 000 Btu hot tub heater
2. Apply all regulations pertaining to low-pressure gas line sizing.
3. Correctly size all gas lines using proper tables (minimum size requirements) and develop a material list.
4. Describe proper testing and purging requirements for low-pressure gas line installations.
5. Describe the process to correctly size the vent, vent connectors and chimney.
6. Describe the process to determine the correct air supply requirements.

B. 2 PSI Gas Line Layout (060405b) ..... 4 Hours

Outcome: ***Install and service pipe, tubing and fittings to a 2-psi gas line installation.***

1. Describe the process for the layout of a 2-psi gas line for a commercial installation including the following appliances:
   a) six hot water boilers
   b) three commercial hot water tanks
2. Apply all regulations pertaining to 2-psi gas line sizing.
3. Correctly size all gas line using the proper tables (maximum size requirements) and develop a material list.
4. Describe proper testing and purging requirements for 2-psi gas line installation.

C. Customer Bulk Storage Tank Installation and Vaporizers (060405c)..... 6 Hours

Outcome: ***Apply rules pertaining to the installation of customer bulk storage tanks and vaporizers for various conditions of use.***

1. List code requirements for installation of customer bulk storage tanks.
2. Describe the process for sizing tanks for customer's applications.
3. Describe tank installation requirements including piping and regulators.
4. Describe valves and accessories for safety relief, liquid withdrawal, vapour withdrawal and filling applications.
5. List the types, sizing and capacities of vaporizers.
6. Describe code requirements, installation procedures and maintenance requirements for vaporizers.

D. Additional Flues and Vents (060405d)..... 4 Hours

Outcome: ***Install and service flues, vents and thermal and electric flue dampers.***

1. List and describe minimum distances and code requirements for the use of direct vented appliances.
2. List the code requirements for power-assisted flues, special flue applications and engineered designed flues.
3. Identify and describe various types of flue dampers including operation and code requirements.

E. Mid- and High Efficiency Gas-Fired Appliances (060405e)..... 6 Hours

Outcome: ***Install and service gas-fired appliances and interpret timing and sequencing diagrams on electronic appliances and gas controlled equipment.***

1. List and describe the basic differences between mid and high efficiency.
2. List the code and manufacturer requirements for the installation of mid and high efficiency appliances.
3. Identify and describe the operation of each of the basic ignition systems used in mid and high efficiency appliances.
4. Interpret timing and sequencing diagrams found on mid and high efficiency appliances.
5. List and describe troubleshooting procedures for mid and high efficiency appliances.
6. State the regulations in relation to air supply requirements for mid and high efficiency appliances.

F. Electrical Circuits and Controls for Commercial Gas Appliances (060405f)..... 6 Hours

Outcome: ***Interpret electrical and electronic wiring diagrams.***

1. Identify electrical and electronic symbols used in gas control and appliance circuits for both ac and dc power.
2. Match symbols on electrical circuits with components on commercial appliance and control equipment.
3. List and describe the common types of electrical circuits found on gas controls and appliances.
4. Identify and describe electrical and thermally operated controls for commercial appliances.
5. List, define and describe common electronic terminology used in gas control and appliance circuits for both ac and dc power.
6. Describe troubleshooting procedures for electronic and electrical controls and appliances.

G. Combustion Analysis and Heat Exchanger Testing (060405g) ..... 4 Hours

Outcome: ***Install and service gas-fired appliances.***

1. Explain factors relating to gas combustion efficiency in natural draft low pressure gas appliance including effects of air supply.
2. Describe correct methods for testing and adjusting combustion characteristics of gas appliances including methods of testing for carbon monoxide.
3. Describe best methods of using combustion analysis test kits.
4. Explain various methods used to check the condition of the heat exchangers.

H. Wiring Electrical Circuits for Mid and High Efficiency Gas Appliances ..... 6 Hours

Outcome: ***Using wiring diagrams wire circuits to mid and high efficiency appliances having electrical and electronic controls.***

1. Identify electrical and electronic symbols used in gas control and appliance circuits for both ac and dc power.
2. Match symbols on electrical circuits with components on commercial appliance and control equipment.
3. Identify the common types of electrical circuits found on gas controls and appliances.
4. Identify and describe electrical and thermally operated controls for commercial appliances.
5. List, define and describe common electronic terminology used in gas control and appliance circuits for both ac and dc power.
6. Correctly wire circuits to mid and high efficiency appliances using manufactures wiring diagrams.
7. Follow prescribed troubleshooting procedures for electronic and electrical controls and appliances.

I. Operational Tests for Mid and High Efficiency Gas-Fired Appliances ..... 6 Hours

Outcome: ***Install and service gas-fired appliances and interpret timing and sequencing diagrams on electronic appliances and gas controlled equipment.***

1. Identify the basic differences between mid and high efficiency.
2. List the code and manufacturer requirements for the installation of mid and high efficiency appliances.
3. Test the operation of each of the basic ignition systems used in mid and high efficiency appliances.
4. Interpret timing and sequencing diagrams found on mid and high efficiency appliances.
5. Test for correct combustion analysis with kits and adjust appliances for maximum safety and efficiency.
6. Follow troubleshooting procedures for mid and high efficiency appliances. Check condition of heat exchanger.
7. Review regulations and manufacturers specifications and measure flue gas temperature, excess air ratio and check compliance of air supply for mid and high efficiency appliances.
8. Tabulate data and discuss results.

J. Domestic Gas Fired Appliances Installation and Servicing Lab ..... 6 Hours

Outcome: ***Check the application of gas codes, manufacturer's requirements, rating plate data, pertaining to the installation of various domestic gas-fired mid and high efficiency appliances. Check for installer responsibilities, location, clearances, gas-line, vent and combustion air requirements.***

1. Check for correct installation requirements with reference to regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to gas-fired appliances regarding installer responsibilities.
2. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to venting of domestic gas-fired appliances.
3. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to combustion air requirements of domestic gas-fired appliances.
4. Assess correct installation requirements in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to domestic gas-fired appliances including (but not limited to): a) boilers, b) clothes dryers, c) counter appliances, d) direct vent and decorative appliances, e) ranges, f) furnace/space heating, g) domestic water heating.
5. Safely test and set appliances operating and safety controls to correct requirements.
6. Check that appliance is operating correctly and according to codes and manufacturer's requirements.

K. Set and Adjust Gas Appliances ..... 6 Hours

Outcome: ***Set and adjust gas fired appliances with respect to gas codes, manufacturer's requirements, and rating plate data.***

1. Check for correct installation requirements with reference to regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to gas-fired appliances regarding installer responsibilities.
2. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to venting of domestic gas-fired appliances.
3. Apply the regulations in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to gas pipe sizing, correct wire gauge and combustion air requirements for domestic gas-fired appliances.
4. Assess correct installation requirements in the B149.1 and the Plumbing and Gas Safety Services Bulletins pertaining to domestic gas-fired appliances including (but not limited to): a) boilers, b) clothes dryers, c) counter appliances, d) direct vent and decorative appliances, e) ranges, f) furnace/space heating, g) domestic water heating.
5. Safely test and set appliances operating and safety controls to correct requirements.
6. Check that appliance is operating correctly and according to codes and manufacturer's requirements.

SECTION SIX:.....RELATED SUBJECTS..... 32 HOURS

A. Trade Math and Science (060406a).....6 Hours

Outcome: ***Calculate hydrostatic pressures, rolling offsets, volume, flow volumes in pipe and grade on pipe in both metric and imperial units.***

1. Describe and demonstrate the process for calculating hydrostatic pressure.
2. Describe and demonstrate the process for calculation rolling offsets in a piping system.
3. Describe and demonstrate the calculations required to determine the volume of various shapes of tanks.
4. Describe and demonstrate the calculations pertaining to determination of flow from pipe.
5. Describe and demonstrate the process for calculating grade.

B. Schematics and Waterline Sketching (060406b).....6 Hours

Outcome: ***Describe a schematic drawing, its contents and the process for drawing it. Take information about water distribution lines from a blueprint and draw the distribution system so that it may be installed where you want it.***

1. Describe a schematic drawing.
2. List the information found on a schematic drawing.
3. Describe the process for drawing a schematic.
4. Describe the procedure for drawing waterlines in residential and commercial applications.

C. Commercial Kitchen Layout and Barrier-Free Washroom Design (060406c) .....8 Hours

Outcome: ***Sketch and draw residential and commercial plumbing installations.***

1. Describe the layout requirements for a commercial kitchen.
2. Review a kitchen equipment specification.
3. Describe various methods of locating fixture rough-in requirements.

D. Bid Depository and Job Estimating (060406d).....4 Hours

Outcome: ***Locate specific information in a full set of blueprints, including specifications.***

1. Describe the purpose of the bid depository.
2. Review various methods used to tender and estimate for a project.
3. List and describe the types of bonds that may be required for a project.

E. Blueprint Package (060406e)..... 6 Hours

Outcome: ***Correctly read and interpret residential and commercial blueprints.***

1. Identify divisions of blueprints.
2. State the information applicable to the plumber trade found on blueprints.
3. Review the application of grid lines.
4. Identify plumbing fixtures and locations of fixtures.
5. Read and interpret site, floor and plot plans.
6. Read and interpret specifications.
7. Determine correct location of DWV and water distribution systems.
8. Analyze blueprints for possible installation conflicts.

Excellence through training and experience

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